MECHANICAL HANDLING
INCORPORATING 'MATERIALS HANDLING'
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STAGES OF A MATERIALS HANDLING SCHEME

ONE OF THE BEST WAYS to appreciate just how much handling is involved in any given industrial organization is to consider the total weight of materials handling throughout the works for every ton of finished goods produced.

It has been stated, for example, that in one American pipe foundry it was found that a total of 50 tons of materials were handled to produce 1 ton of finished goods. And this is not an isolated case. Totals of 140 or 150 tons of materials handled for every ton of finished goods are not unknown.

A moment's reflection upon this simple calculation can be a salutary experience. In fact, if every manufacturing company in Great Britain were to make a similar analysis, the colossal drain on the resources of this country would be much more readily appreciated.

The variety of materials to be handled in, for example, a typical engineering factory, are many. Quite apart from primary raw materials, there are the many others which are vital to the efficient maintenance of production. These may include such diverse items as fuel, packaging materials, foundry sand, lubricants, cutting oils, press tools, dies and moulds, to mention just a few. There is also the collection and disposal of waste and scrap to be considered, and this can often amount to many tons per day. Even the handling of food for the works canteen can be a problem in large organizations.

The difficulties are amplified considerably where multiple handling is involved : most of the materials mentioned above would have to be handled not once but several times during the normal course of production. Putting into and taking out of store would usually represent a minimum of two handling operations. Even if only two other handling operations were needed during actual manufacture, there would be a total of four handling tasks involved before the goods reached the finished products store. It is obvious, therefore, that a factory with a total input of, say, 20 tons of materials a day, must, in these circumstances, expect to handle a minimum aggregate of 80 tons per day. In actual fact, in all but the very simplest productive unit, the handling tonnage would undoubtedly be much greater.

When all these factors are considered, it is not surprising that handling costs figure so largely in many industries. They also serve to illustrate how vitally important it is that every handling operation should be most carefully scrutinized to discover whether, perhaps, it can be avoided altogether by the use of better methods.

It is thus wise—and profitable—to consider the first stages of any materials handling scheme as being simply ' a process of elimination'. Once every unnecessary handling operation has been eliminated, then is the time to study the remainder to discover how they can best be mechanized.

SEVENTH MECHANICAL HANDLING EXHIBITION - 1960

The Seventh Mechanical Handling Exhibition (organized by this journal) will be held next year at Earls Court, London, from Tuesday, May 3rd, until Friday, May 13th. Make a note.

Pour les lecteurs de l'étranger
Für unsere ausländischen Leser
Para los lectores de ultramar

SUMMARY OF CONTENTS

For readers overseas

SOMMAIRE EN FRANCAIS

Transmission hydrostatique pour véhicules page 440
Bien que la forme hydrostatique de transmission hydraulique utilisant le déplacement positif de l'huile entre pompe et moteur s'emploie déjà avec succès depuis de longues années pour une grande diversité d'applications, ce n'est que récemment que l'on a mis au point des moteurs qui combinent une puissance suffisante à un poids et des dimensions acceptables pour emploi sur des véhicules. Deux fabricants anglais viennent de présenter récemment des systèmes de transmission hydrostatique dont on lira la description dans cet article.

Encore un pas en avant vers l'automation
par un collaborateur spécial. page 444
Il y a de cela quelque deux ans et demi, on publiait dans *Mechanical Handling* un compte rendu technique intitulé 'Un pas vers l'automation', donnant une description complète d'une nouvelle machine de triage des lettres pour la Poste anglaise, avec un seul opérateur. Il s'agissait d'une machine construite à la main par les P.T.T. anglaises, dans leur Station de la Recherche, et l'on peut maintenant faire la description du stade suivant de son développement. Cet article traite de l'évolution et des performances des modèles de production, qui sont basés sur l'expérience acquise grâce à la machine prototype antérieure.

Une installation transporteuse moderne pour le sucre brut page 455
C'est la description des procédés nécessaires à la production du sucre brut et des méthodes de manutention du produit, en particulier dans une nouvelle installation de la République Dominicaine.

Matériel de manutention mécanique dans un petit atelier page 458
Par P. C. MacCulloch
Une firme londonienne de génie civil a transféré son atelier d'outillage et de fabrication d'outillage de l'emplacement de ses bureaux principaux à son dépôt, situé dans une autre partie de Londres. L'histoire de la recherche sur les méthodes d'opération qui aboutit à la proposition de s'installer à ce nouvel emplacement, la réorganisation complète de l'atelier et l'adoption de nouvelles méthodes et d'un contrôle nouveau pour le travail font l'objet de cet article.

Manutention des matériaux dans une centrale électrique moderne de l'intérieur, 2ème Partie page 465
Par J. M. Besking, B.Sc.(Eng.)
C'est la suite d'un article ayant paru dans le numéro d'août de *Mechanical Handling* Cette 2ème Partie expose la disposition générale du système de manutention du charbon. Elle traite aussi du matériel installé pour empiler les stocks de charbon.

Foire de Hanovre page 477
Description des remarquables matériels te installations de manutention mécanique qui ont été présentés à cette exposition internationale. Parmi les articles exposés, les grues et les machines de terrassement de construction anglaise ont été très en évidence.

Système de maltage Wanderheufen page 480
C'est la description d'un matériel installé en Irlande, qui serait, dit-on, le seul système pneumatique de maltage, soit à tambour, soit type boite, existant dans ce pays.

Grue d'un modèle nouveau pour les quais page 483
Après plusieurs années d'étude et de mise au point, un fabricant anglais vient de présenter un type entièrement nouveau de grue pour installations portuaires. D'un aspect particulièrement net et agréable, cette machine lève 5.080 kg à 24, 4 m, ou 6.096 kg à 21, 3 m de rayon et elle peut s'adapter pour travaux à la benne preneuse à l'occasion. Cette grue est construite à la soudure, employant un minimum de pièces de charpente, qui sont boulonnées ensemble sur les lieux de travail.

Chariots Elevateurs a Fourche Fonctionnant au Gaz page 485
Le fonctionnement des véhicules industriels et agricoles au gaz de pétrole liquéfié peut être réalisé soit en convertissant le carburateur des systèmes essence ou Diesel existant déjà, soit par l'installation de matériel neuf marchant au gaz. Cet article examine le système d'alimentation en gaz en quantité Calor Gaz pour chariots élévateurs à fourche, ainsi que la trousse de la Lipton Carburetter Company pour transformer les moteurs à essence ou Diesel en moteurs fonctionnant au gaz.

Progrès rapides dans la mécanisation des méthodes de construction page 487
Par T. W. Highgate
C'est la description de la 13ème Exposition du Matériel pour le Bâtiment, tenue à Londres et organisée par le Ministère des Travaux Publics. Près de 125 fabricants et distributeurs de matériel et d'équipement de construction et du bâtiment y ont participé ou contribué. Le but recherché était de montrer aux entrepreneurs et ouvriers du bâtiment les plus récents appareils et machines disponibles pour accélérer la construction et faciliter la diminution des frais de construction.

Matériel Anglais de Manutention Mécanique a L'Etranger page 491

Revue de L'Equipment Nouveau page 493

Resumes et Références page 496
Les articles sur la manutention mécanique publiés dans les revues et journaux techniques et industriels dans le monde entier ont catalogues et abrégés sous cettes rubrique.

Brevets récents page 498

INHALTSÜBERSICHT AUF DEUTSCH

Hydrostatische Getriebe für Fahrzeuge Seite 440
Obwohl die hydrostatische Form hydraulischer Getriebe unter Ausnutzung zwangsläufiger Verdrängung des Öls zwischen Pumpe und Motor sich bereits seit vielen Jahren für die verschiedensten Anwendungszwecke bewährt hat, befinden sich Aggregate ausreichender Leistung bei gleichzeitig zweckmässigen Grössen—und Gewichtsverhältnissen für die Anwendung in Fahrzeugen erst seit kurzer Zeit im Einsatz. Von zwei britischen Firmen wurden kürzlich hydrostatische Getriebe eingeführt, welche im vorliegenden Artikel beschrieben werden.

Ein weiterer Schritt zur Automatisierung Seite 444
Von einem Spezialmitarbeiter
Vor etwa zweieinhalb Jahren erschien in *Mechanical Handling* ein Artikel " Ein Schritt zur Automatisierung," in dem eine neue britische Briefsortiermaschine der Postbehörde für die Einmannbedienung ausführlich beschrieben wurde. Diese Maschine war in der Forschungsabteilung der britischen Postbehörde handgebaut worden, und nunmehr kann ihr nächstes Entwicklungsstadium beschrieben werden. Die Entwicklung und Leistung der Produktionsmodelle, die anhand der mit der Prototypmaschine gewonnenen Erfahrungen erzielt worden ist, wird hier behandelt.

Eine neue Förderanlage für Rohzucker Seite 455
Die verschiedenen Vorgänge der Rohzuckerproduktion und die hierbei angewandten Fördermethoden, besonders in einer Anlage in der Dominikanischen Republik, werden in diesem Artikel behandelt.

Mechanisierung in einer kleinen Werkstatt Seite 458
Von P. C. MacCulloch
Eine Londoner Ingenieurbaufirma verlegte ihre Werkzeugmacherei von der Hauptgeschäftsstelle zu ihrem Lagerplatz in einem anderen Teil Londons. Die Entwicklungsgeschichte der Untersuchungen von Arbeitsmethoden, die zu diesem Umzug Anlass gaben, die komplette Umplanung der Werkstatt sowie die

Einführung neuer Arbeitsmethoden und Arbeitsweisen bilden den Gegenstand dieses Artikels.

Materialfluss in einem modernen Inlandkraftwerk, Teil II Seite 465
Von J. M. Besking, B.Sc.(Eng.)
Eine Fortsetzung des Artikels, der in der Augustnummer von *Mechanical Handling* erschien. Teil II beschreibt die allgemeine Anordnung der Kohlenförderanlage und befasst sich ferner mit der zur Haldenlagerung von Kohle errichteten Anlage.

Industriemesse Hannover Seite 477
Hier werden die hervorragenden Förder- und Hebeanlagen beschrieben, die auf dieser internationalen Ausstellung gezeigt wurden. Krane und Erdbewegungsgroßgeräte britischer Fabrikation nahmen unter dem Ausstellungsgut einen bedeutenden Platz ein.

Wanderhaufen-Mälzanlage Seite 480
In diesem Artikel wird eine in Irland errichtete Anlage beschrieben, welche die einzige pneumatische Trommel — oder Kastenmälzanlage im Lande sein soll.

Hafenkran neuartiger Konstruktion Seite 483
Nach mehrjähriger Konstruktions—und Entwicklungsarbeit wurde von einem britischen Fabrikanten ein völlig neuartiger Hafenkran eingeführt. Er zeichnet sich durch besonders saubere Linienführung und formschöne Gestaltung aus und hat ein Hubvermögen von 5080 kg bei 24, 4 m Ausladung bzw. 6096 kg bei 21, 3 m Ausladung und ist auch für gelegentliche Greiferarbeiten einsetzbar. Es handelt sich um eine Schweissausführung unter Anwendung einer Mindestzahl von Verbindungsstücken, die an Ort und Stelle verschraubt werden.

Gasbetriebene Gabelstapler Seite 485
Der Antrieb industrieller und landwirtschaftlicher Fahrzeuge durch verflüssigtes Erdölgas lässt sich entweder durch einen entsprechenden Umbau von Vergasern bestehender Benzin—oder Dieselanlagen oder auch durch Einbau neuer Gasantriebe erzielen. Hier wird sowohl die Calor-Gasanlage für Gabelstapler als auch die Ausrüstung der Lipton Carburettor Company zur Umstellung von Benzin—und Dieselmotoren auf den Gasbetrieb beschrieben.

Schnelle Fortschritte in der Mechanisierung von Bauvorgängen
Von T. W. Highgate Seite 487
Eine Beschreibung der vom Ministerium für öffentliche Arbeiten veranstalteten 13. Baumaschinenausstellung. Hieran nahmen etwa 125 Baumaschinenfabrikanten und—vertriebsfirmen teil. Diese Ausstellung dient dazu, Bauunternehmern und Bauarbeitern die neuesten zur Beschleunigung von Bauarbeiten und Herabsetzung der Baukosten zur Verfügung stehenden Maschinen und Ausrüstungen vorzuführen.

Britische Förderanlagen Und Hebezeuge im Ausland Seite 491

Besprechung Neuer Anlagen Seite 493
Auszüge und Nachweise Seite 496
Neue Patente Seite 498

SUMARIO EN ESPAÑOL

Transmisión hidrostática para vehículos Pág. 440
Aunque la variedad hidrostática de la transmisión hidráulica, en que se usa el desplazamiento efectivo del aceite entre la bomba y el motor, ha venido usándose con éxito desde hace mucho años en toda una diversidad de aplicaciones, no ha sido sino en fecha reciente que han sido creadas unidades que combinan fuerza suficiente con peso y dimensiones aceptables para su uso en vehículos. Los constructores británicos han introducido recientemente sistemas de transmisión hidrostática que vienen descritos en este artículo.

Otro paso hacia la automatización
Por un corresponsal especial Pág. 444
Hace unos dos años y medio fué publicado en *Mechanical Handling* un informe técnico titulado 'Un paso hacia la automatización', en el cual figuraban los datos de una nueva máquina clasificadora de cartas empleada en los Correos ingleses y controlada por un solo empleado. Dicha máquina fué construída a mano por el Post Office británico en su estación de investigaciones, y ahora puede ya describirse la nueva etapa de su desarrollo. Se trata de la evolución y actuación de los modelos en producción basados en la experiencia adquirida con la máquina prototipo.

Una instalación moderna para el movimiento de azúcar en crudo Pág. 455
Descripción de los procesos que integran la producción del azúcar el bruto y los procedimientos de manipulación del producto, especialmente en una nueva instalación en la República Dominicana.

Instalación de manipuleo mecánico en un taller pequeño
Por P. C. MacCulloch Pág. 458
Una firma londinense de ingeniería civil ha transladado su taller de herramientas de la sede central a otro local que está situado en otra parte de Londres. El historial de toda la investigación de los métodos de explotación, que culminó en la propuesta de translado a los otros locales, así como el detalle completo de la instalación de los nuevos talleres y la introducción de nuevos métodos de control y de trabajo, son el tema de que trada el presente artículo.

Movimiento de materiales en una moderna central eléctrica del interior, Parte II
Por J. M. Besking, B.Sc.(Eng.) Pág. 465
Es la continuación de un artículo que apareció en el número de Agosto de *Mechanical Handling*. La Parte II describe la disposición general del sistema de movimiento de carbones. También trata de la planta instalada para apilamiento de las reservas de carbón.

Feria de Hanóver Pág. 477
Descripción de los importantes equipos y plantas para manipuleo mecánico que pudieron verse en esta exposición internacional. Entre los elementos expuestos se destacaron mucho una cantidad de grúas y maquinaria para movimiento de tierras de construcción británica.

Sistema Wanderhaufen de malteado Pág. 480
Damos aquí la descripción de una planta instalada en Irlanda, de la cual se afirma que es la única instalación neumática de malteado, ya de tambor o de caja, en aquel país.

Grúa de muelles de nuevo diseño Pág. 483
Después de varios años de proyectos y experimentos ha sido introducida por un constructor británico una grúa de muelle de un tipo totalmente nuevo. De aspecto especialmente nítido y agradable, puede manipular 5080 kg izándolos a 24, 4 m, o 6096 kg a 21, 3 m de radio, pudiéndose adaptar para uso con graba en casos de necesidad. La grúa está construida de elementos soldados, siendo el mínimo el número de miembros de que se compone, los cuales se empernan unos a otros en el emplazamiento.

Carretones de horquilla elevadora accionados por gas Pág. 485
El accionamiento de vehículos industriales y agrícolas por gas de petróleo licuado puede lograrse ya sea por la conversión de los carburadores de los sistemas de gasolina o diesel existentes o por la instalación de equipos nuevos accionados por gas. Se examina el sistema de suministro Calor Gas para carretones de horquilla elevadora, así como el equipo de la Lipton Carburettor Company para la conversión de motores de gasolina o diesel para el consumo de gas.

Rápidos adelantos en la mecanización de los procesos de la construcción
Por T. W. Highgate Pág. 487
Descripción de la 13ª Exposición de Plantas para la Construcción que se celebró en Londres, organizada por el Ministerio Británico de Obras Públicas. La respaldaron unos 125 constructores y distribuidores de plantas y equipos para la construcción. Su objeto fué mostrar a los contratistas y a los que trabajan en el ramo de la construcción la más reciente maquinaria que existe para acelera la construcción y disminuir los costos.

Equipos británicos de manipulación mecánica en ultramar Pág. 491
Revista de los nuevos equipos Pág. 493

Extractos y referencias Pág 496
En esta sección vienen clasificados los artículos sobre manipulación mecánica publicados en las revistas técnicas e industriales de todo el mundo, haciéndose constar un extracto de los mismos.

Patentes recientes Pág. 498

HYDROSTATIC TRANSMISSION FOR VEHICLES

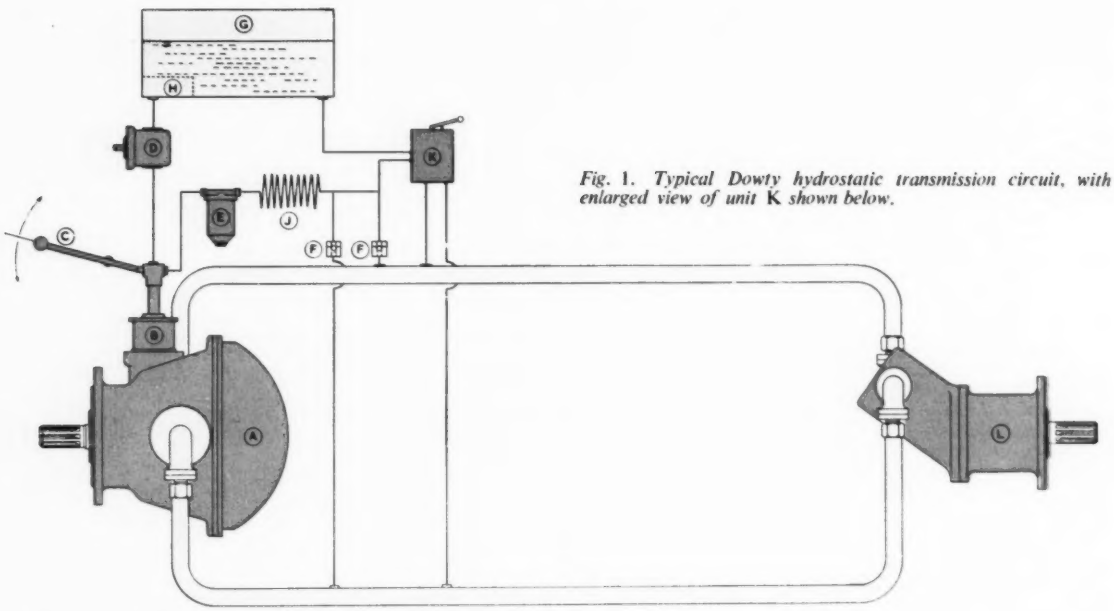
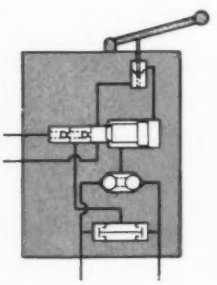


Fig. 1. Typical Dowty hydrostatic transmission circuit, with an enlarged view of unit K *shown below.*



KEY

A Pump
B Servo jack and control valve
C Speed control lever
D Booster pump
E Filter
F Non return valve
G Reservoir
H Suction strainer
J Cooler
K Releif and shuttle valve block
L Motor

ALTHOUGH the hydrostatic form of hydraulic transmission utilizing positive displacement of the oil between pump and motor has been used with success for many years on a variety of applications, it is only recently that units have been developed combining sufficient power with acceptable weight and size for use on vehicles. Two British manufacturers, Dowty Hydraulic Units, Ltd. and Joseph Lucas, Ltd., have recently introduced systems of hydrostatic transmission to their own design.

Dowty Hydraulic Units, Ltd.

Several years ago Dowty began development on the Transmatic drive designed to meet the requirements of vehicle applications. Based on well proven practices in conjunction with a straight forward design, this transmission has now reached a stage where it is possible for it to be demonstrated as fitted to production vehicles. It was recently shown applied to a Road-Marshall Highwayman 8/13-ton diesel road-roller produced by Marshall Sons & Co., Ltd., and on a type 48 D.H. narrow gauge locomotive, produced by Ruston & Hornsby, Ltd. An adaptation of a standard products model tractor was also demonstrated, this vehicle was used for early development test but is only a 'mobile test bed', not a production vehicle.

For vehicles which spend the majority of their lives in the indirect drive ratios and require a high degree of manœuvrability this system offers many advantages. These are, (1) a single lever control which actuates the complete range of movement from full-ahead to full astern; (2) a stepless transmission which avoids the difficulty of changing gear when under lead. Vehicles can be inched forward and speed increased until the optimum engine output is achieved; (3) elimination of many parts, including the mechanical drive line, gear shift system and reversing mechanism, allowing great flexibility in vehicle design and better space utilization. Two pipe-lines are the only necessary link between the engine mounted pump and the motor or motors driving the wheels or tracks; (4) manœuvrability under difficult conditions such as steep inclines and poor holding ground is exceptional; (5) the drive acts as a brake when the control lever is moved towards the central position at which the wheels are locked. Wheel brakes other than parking brake, are not needed; (6) the ability to choose any transmission ratio between zero and 1 : 1 both forward and reverse enables the engine to run

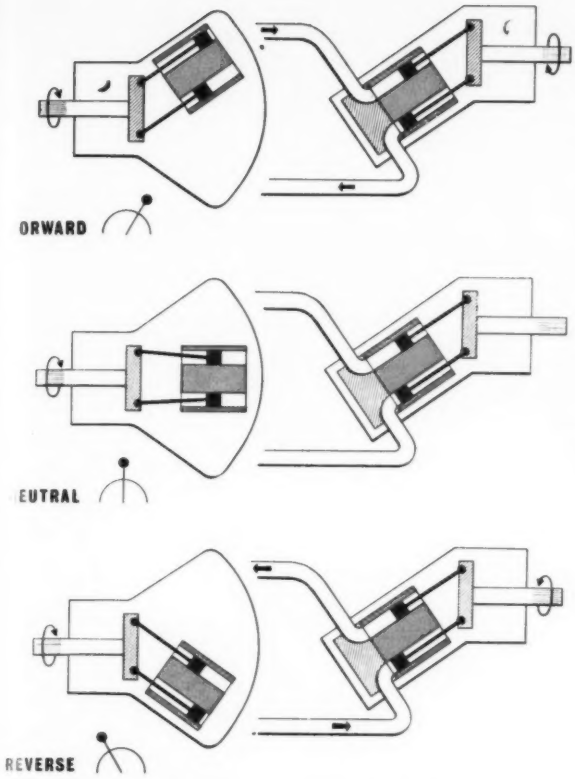
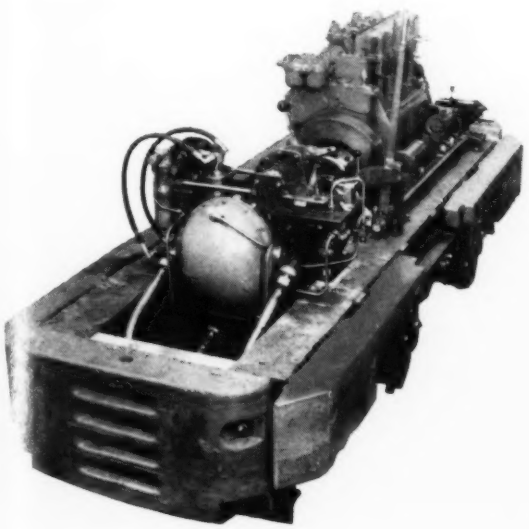


Fig. 2. Dowty Transmatic drive, principle of operation.

constantly at the optimum speed, makes an economic use of the engine horsepower; (7) the characteristics of the transmission prevent a driver from abusing and over-loading the engine. Various control refinements can be incorporated including the prevention of engine stall under overload conditions; (8) extensive endurance tests have shown that very little maintenance is required between conventional overhaul periods and that the life of associated drive line components is extended as the result of the shock-free drive.

Fig. 3. Chassis of Ruston 48 D.H. locomotive with Dowty Transmatic drive.



Applications for which the Dowty transmatic drive is particularly suitable cover a broad field. Cranes, hoists, fork lift trucks, cargo winches, derricks and other handling equipment, as well as crawler tractors, earth-moving machines, tractors for agricultural and industrial purposes are but a few of the more important applications.

The Transmatic drive consists of a variable displacement hydraulic pump driven by the prime mover, and a fixed displacement hydraulic motor which is normally coupled to a final-drive reduction gearing. The pump is of axial-piston tilting-head type, the angle of the pumping elements being altered in order to adjust the stroke of the pistons. The motor utilizes identical rotating parts but is set at the maximum angle of 35 deg.

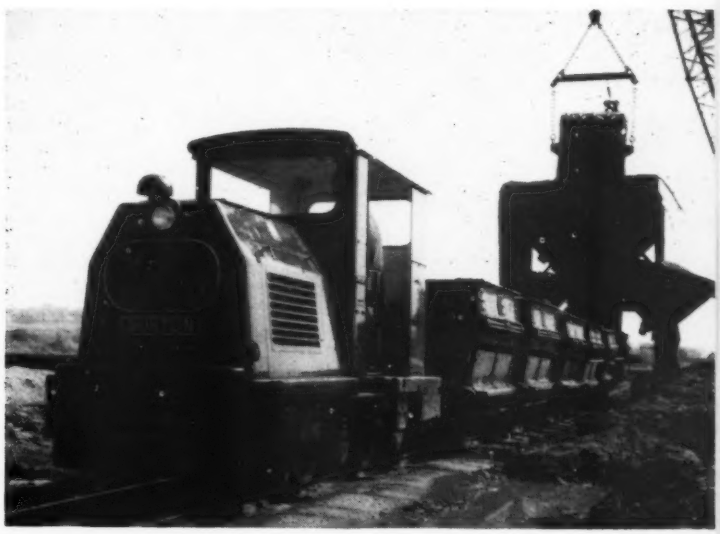
The pump, motor and two main connecting pipes form the primary circuit. A low-pressure circuit is also utilized to boost the suction side of the primary circuit and to filter and de-aerate the whole system. This secondary system consists of a Dowty gear pump, micronic filter, the circuit control valves and a small reservoir. A cooler may also be incorporated in this low-pressure circuit.

The angle of the pump is adjusted by a servo jack and only a very light hand load is required to adjust the pump output. A mechanical linkage is normally employed between the servo and the driver's control. A high-pressure release valve is incorporated to protect the system against sudden overload. To prevent a pressure build-up and vehicle movements should the engine be started with the driver's control away from neutral, a means of unloading relief valve is provided.

When the pump angle is reduced, the roles of pump and motor reverse, the pump motor in the engine or other prime mover. The effect is similar to the use of a low gear, as the brake. Effective braking is obtained when the pump angle is at zero and the drive is locked hydraulically. The retention of some form of ancillary mechanical brake is recommended, and is normally a legal requirement.

The rated performance of the type 240 Transmatic drive is based on a torque multiplication of 4:1 and an input to the pump of 60 b.h.p. at 2,000 r.p.m. Within this rating the overall efficiency does not fall below 80 per cent, the optimum being approximately 90 per cent at half motor speed. At 60 b.h.p. input the motor offers full torque from zero to 400 r.p.m. Between 400 and 2,000 r.p.m. the torque varies

Fig. 4. Ruston 48 D.H. locomotive with Transmatic drive undergoing field trials hauling sand and gravel.



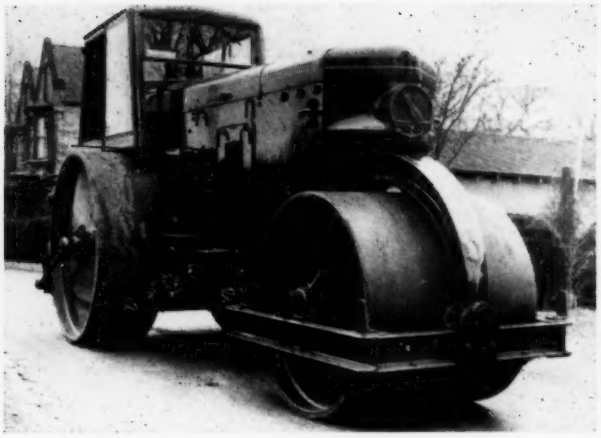


Fig. 5. 8/13 ton diesel road-roller made by Marshall Sons & Co., Ltd., fitted with Transmatic drive.

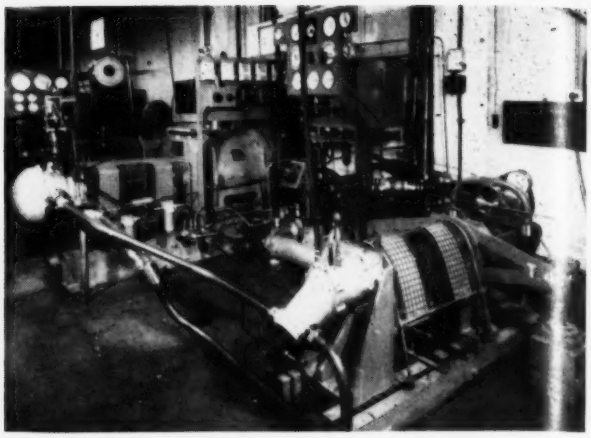


Fig. 6. This Dowty test-rig, enables complete transmissions to be tested under the full range of operating conditions, any chosen cycle of which can be continuously and automatically reproduced.

inversely with speed in order to maintain a constant horsepower. Higher torque and speed ratios can be considered by suitable matching with the characteristics of the application, alternatively lower torque multiplications at higher input powers are possible.

Other sizes of transmissions capable of handling a variety of powers are under development by Dowty's.

Basic Data—Type 240 Transmatic Drive

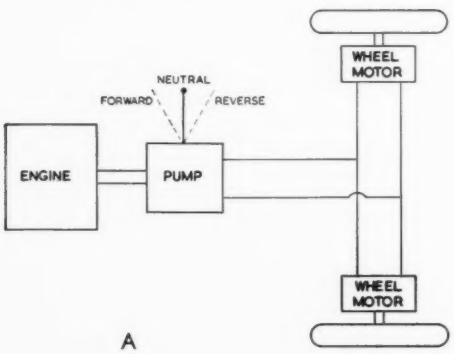
Pump and motor displacement	12·41 in³
Number of cylinders	10
Rated pump maximum input speed	2,000 r.p.m.
Maximum continuous operating pressure	4,000 lb/in²
Maximum flow	89·5 gal/min
Pump swash angle	35 deg
Motor speeds available	0-2,000 r.p.m. in either direction
Maximum torque at rated pressure	635 lb. ft.

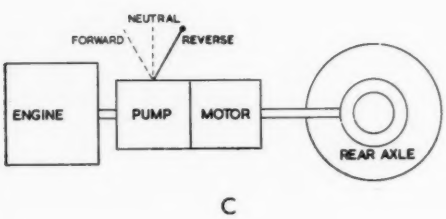
Joseph Lucas, Ltd.

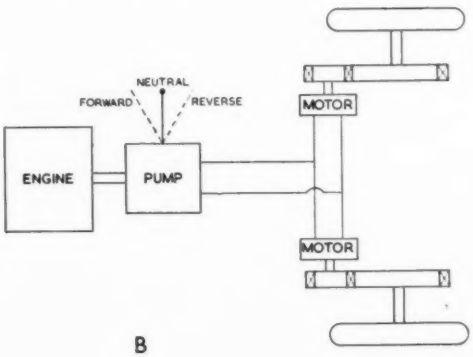
Four different systems are included in the development of a hydrostatic transmission by Joseph Lucas, Ltd. First announced at the Smithfield Show in December last this transmission was recently demonstrated as applied to tractors. It comprises a Lucas axial piston variable capacity hydraulic pump driven by the tractor engine, the output from the pump being connected by high pressure steel tubing to low speed wheel motors driving directly on to the rear wheels.

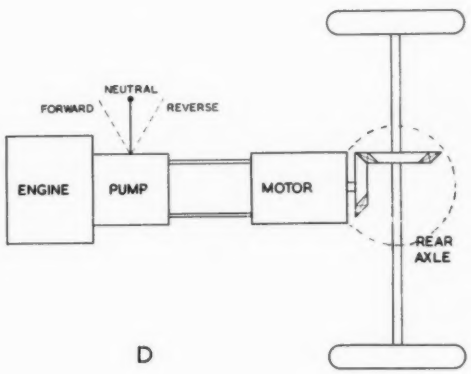
The motors are connected in parallel to the pump so as

Fig. 7. Lucas systems of hydraulic transmission. A, using slow speed wheel motors; B, using high speed wheel motors; C, back to back hydraulic transmission gearbox replacement; D, hydranlic transmission gearbox replacement.









to permit them to operate at the same pressure drop and torque while the flow through each will vary according to the required speed of rotation of the wheel, that is to say, normal unlimited differential action is provided. The pump and motor circuit is closed and internal leakage of the units is returned direct to the transmission oil tank, any loss is made up from the same tank by an engine driven boost pump supplying low pressure side of the main pump. The low pressure side of the circuit is maintained at approximately 100 lb/sq. in which ensures adequate filling of the main transmission pump cylinders at maximum speed, keeps the system free from air and permits servo-operation of the pump cam plate over the entire range. No cooling is provided for the transmission oil apart from the natural radiation from the tank surfaces and external pipes. The maximum system pressure is safeguarded by a relief valve which acts in forward, reverse and overdrive conditions to connect the high and low pressure sides of the main circuit.

Control of the tractor is effected by the engine throttle on the steering column and the pump stroke control lever. Stroke control of this lever is operated by an integral servo piston which is connected directly to the cam plate of the pump. The pump consists basically of a seven-piston axial unit having a cam plate movable over a range of 20 deg in either direction. The flow from the pump in either direction is controlled by the cam plate angle moving through the zero or neutral point so giving an infinitely variable speed from zero to maximum in either a forward or reverse direction.

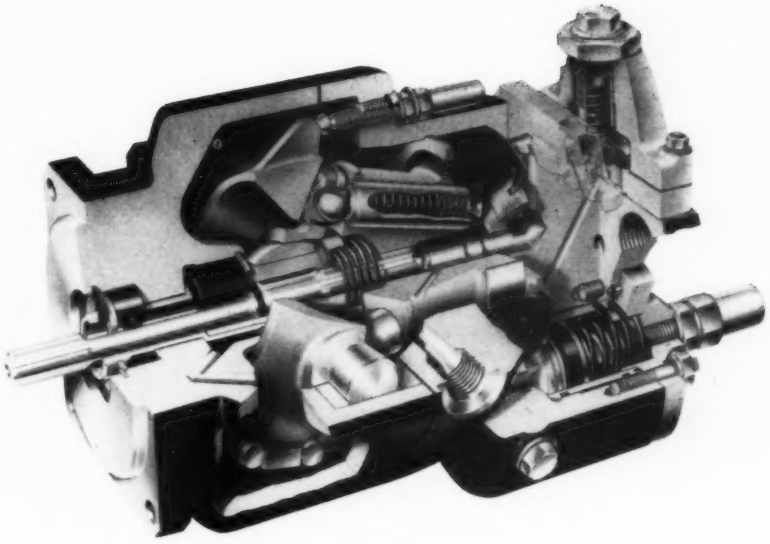


Fig. 8. Section through the Lucas hydraulic pump type 1P. 525.

There is an alternative arrangement to the system described above where the pump is connected in series to low speed wheel motors, instead of being parallel. This enables smaller hydraulic units to be incorporated and overcomes a previous drawback of the system whereby differential action was impossible and control of the tractor from a steering point of view became impracticable. Lucas have however evolved a device which overcomes this disadvantage and allows normal differential action to take place. With this device it is also possible to provide 'limited slip' differential action which can also be locked to overcome wheel spin conditions.

The main advantages of the Lucas hydrostatic transmission as applied to tractors are single lever control, infinitely variable speed range down to zero, no clutch pedal to operate and ability to change gear ratio without stopping the tractor

A second system under development makes use of the engine to drive the variable stroke pump in a similar manner to that described above, but the hydraulic flow from the pump is connected to two Lucas high speed hydraulic motors each of which is connected to the rear wheels through reduction gearing. This system is shown in Fig. 7B.

With a third method of hydrostatic transmission the engine drives a pump as in the two previous examples but the pump is connected hydraulically to a hydraulic motor which drives the rear axle through a normal mechanical transmission shaft and a normal mechanical differential gearing. This is known as the 'Back-to-back' system.

A further application of this principle can be achieved by mounting the hydraulic motor direct on to the differential casing thus eliminating the normal propeller shaft as shown in Fig. 7D.

Independent hydraulic braking on each wheel can be achieved by linking valves to conventional mechanical brake pedals, use of this can assist in tight turns often required in field work. This is in addition to the limited slip or truly locked differential features provided in the first two systems described.

Fig. 9. A Fordson Major diesel tractor fitted with Lucas hydrostatic transmission.

A FURTHER STEP TOWARDS AUTOMATION

From prototype to production model in British Post Office letter sorting mechanisation

by a Special Contributor

SOME TWO-AND-A-HALF YEARS ago, in an exclusive technical report entitled 'A Step Towards Automation?' *Mechanical Handling* published full details of a new British Post Office single-operator letter sorting machine, and suggested that the method of marrying-up information storage and mechanical handling as used in this machine, might well indicate ways and means of economically solving a wide range of automation and semi-automation control and handling problems in numerous industries. The machine in question was hand-made by the British General Post Office at its Dollis Hill Research Station and, although considered as a prototype has, in fact, given a very good account o itself at Southampton sorting office, where it has been i regular use for about two years. Now the next stage of it development can be described, that of the evolution an performance of production models based upon Britis Post office experience with the prototype machine.

About two years ago field trials revealed the need fo various changes in the technical design of the Post Offic prototype letter sorting machine and in the operation facilities provided. The work of preparing a suitabl specification was put in hand and in due course a contrac

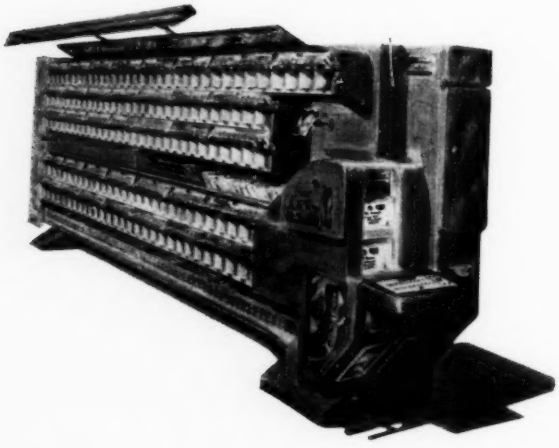


Fig. 1. Artist's impression of the Thrissell British Post Office lett sorting machine, as visualised prior to its initial construction and assembl This sketch was used to establish the external contours of the new machin and to blend functional requirements into clean, harmonious lines. (Se Fig. 2)

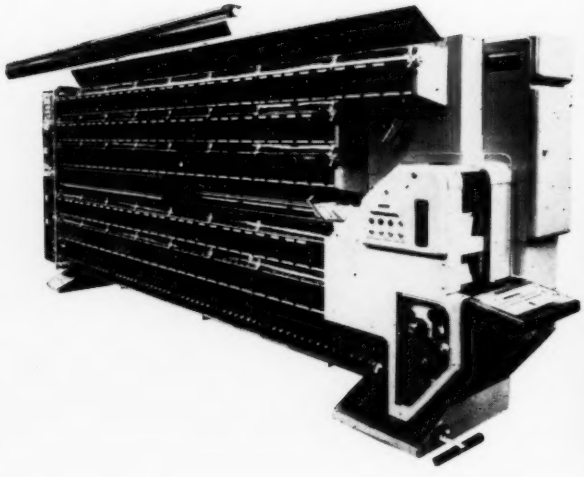


Fig. 2. The Thrissell British Post Office letter sorting machine, as constructed. This machine has a different layout to that of the original prototype machine described in an earlier issue of 'Mechanical Handling' and incorporates numerous improvements.

Fig. 3a. Operator at work on the new letter sorting machine, during demonstration at the manufacturer's works.

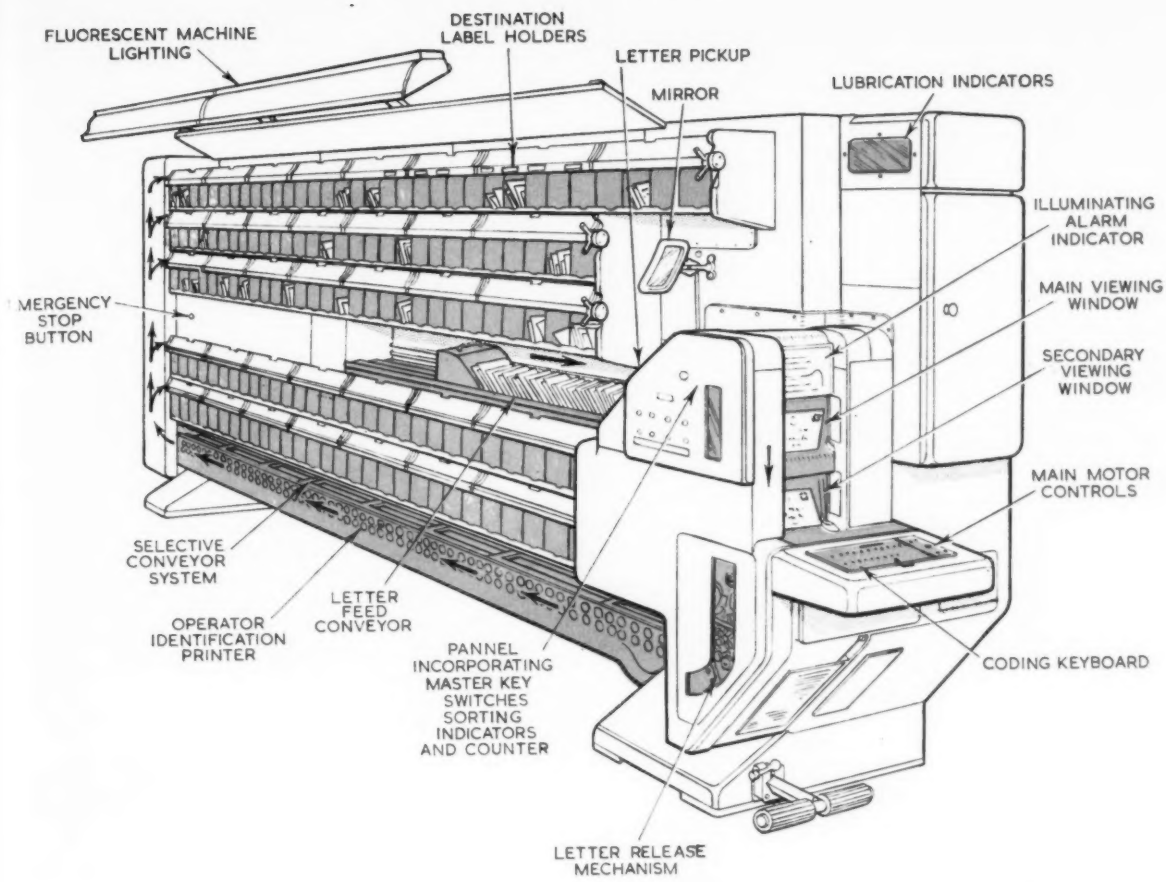


Fig. 3b. Diagram of the new machine from front three-quarter aspect.

was placed with a manufacturer for the production-design and manufacture of 20 machines. The manufacturer in question was The Thrissell Engineering Co., Ltd., a firm which specialises in the design and manufacture of machinery for the tobacco, printing, boxmaking and allied trades, and is in fact a subsidiary of the well known Molins Machine Co., Ltd., inventors and constructors of machinery for the tobacco industry.

Basic Layout of the New Machine

The Thrissell Post Office Letter Sorting Machine is of necessity, similar in general appearance to the original prototype machine. However it incorporates numerous improvements and novel features. It was redesigned to meet stringent G.P.O. requirements, and in addition, it incorporates design features based upon a first-hand study of letter sorting mechanisation by the manufacturers and sub-contractors, Electronic Instruments, Ltd., who were responsible for the design and manufacture of the complex electronic equipment which is incorporated.

Fig. 1 shows an artist's impression of what the new machine would look like, as visualised prior to its initail construction and assembly. This sketch was used to establish the general layout of new and improved features and to blend the external contours into clean and harmonious lines. Fig. 2 shows the first production model actually built, its appearance being almost identical with that of the artist's impression. Fig. 3a shows an operator at work on the new machine, during a demonstration at the manufacturer's works at Bristol. Fig. 3b is a keyed diagram of the

layout of the new machine, seen from the presentation or front end and looking along the face carrying the letter conveyors. A back three-quarter view of the new machine is shown in Fig. 4 and a back view with centre panel doors open, in Fig. 5a. Fig. 5b is a keyed diagram of the back of the machine, showing the location of some of the electric and electronic equipment and part of the memory system.

Description of the New Machine

The new letter sorting machine consists of a letter feed conveyor, a letter pick-up mechanism, a device to present letters before the operator, a keyboard desk, a letter release mechanism and a selective conveyor system which routes the letters into the correct row of boxes (one of five rows) and thence into the correct boxes, as destined by the operator.

The letters are first stacked on to a feed conveyor, which is automatically started and stopped by a photo-electric device. Letters can be added while the machine is running. A full conveyor stack will last about 30 min. at normal reading and keying speed. Each letter in turn is picked up from the stack by an automatic suction mechanism. This is designed to prevent the feeding of two letters at once. The picking-up process is visible to the operator by means of a suitably located mirror. Incidentally, for research, reference library, industrial and commercial use, a letter sorting machine could sort cards containing all manner of information, identical methods of feeding and picking-up being employed. A similar machine might even sort cheques in clearing houses, etc.

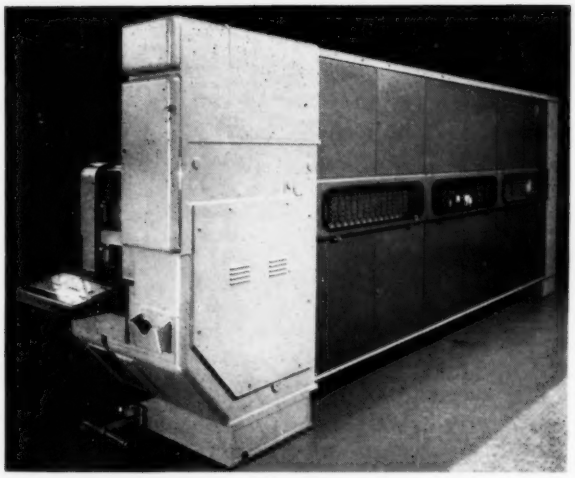


Fig. 4. Back three-quarter view of the machine from the presentation end.

After being picked-up, each letter, or data card is mechanically fed into the previewing window, moving slowly in a horizontal path towards the operator and so into vision and then being rapidly transferred out of vision when read. The time available for this initial reading operation is under the full control of the operator and it has no time relationship with the machine rythym. More or less simultaneously with this pre-viewing of a letter, the operator presses a pair of keys, producing a code corresponding to the destination of a previous letter, which is in the lower or main viewing window when the letter referred to above is in the top or previewing window. The keying action causes the letter in the lower window to be sent on its way, into a two-position combined waiting and synchronising trap, prior to delivery into the letter conveying system of the machine, as described elsewhere below. As the letter in the lower window drops out of sight, the previewed letter in the top window drops down into the lower or main viewing window. The whole cycle is then repeated.

The keyboard contains 12 left-hand keys and 12 right-hand keys, giving 144 codes, each consisting of one pair of keys. The operator is, of course, a properly trained man and has memorised the various keyboard combinations. A cancel key is fitted on the keyboard and this enables the operator to cancel out any mistakes made in keying, whereupon the letter in question will be conveyed into a cancel box for susequent re-transfer by hand or by machine into the correct destination box. A further single key enables letters to be sent to a special box for letters which are insufficiently addressed or which, for any other reason, cannot be normally sorted.

The machine is electronically operated and controlled and is capable of receiving letters at a rate of 6,600 per hr. Average operators work at about half this speed, the limiting factor being the rate at which a man can read an address and operate the appropriate keys. This represents an appreciable increase on the usual speed of hand sorting. A further advantage incorporated in the machine is a change-over arrangement, similar to that adopted in electronic computors, which permits the choice of four different sorting combinations to deal with say, two incoming and two outgoing mails. This feature is further described in later passages.

If two successive letters occur which by shape, colour or other peculiarity, are known to have identical addresses (e.g. football pool replies), or which are legibly marked for a very familiar address, then the operator can momentarily exceed the intrinsic speed of the machine. This is because the control system is designed to include an anticipation feature, so that the keying rate for two succesive letters can be very much faster than 6,600 per hr. In this connection it should be noted that although both the letter presentation and the keyboard operation take place entirely at any random time 'asynchronous time' chosen by the operator, the letters can only be received and handled by the machine at its own rhythmic time 'synchronous time'. For this reason each letter in turn is despatched from the lower viewing window into a synchronising timing device. This releases the letters, in turn, into the machine at the correct time, i.e. it synchronises them with the machine rhythm.

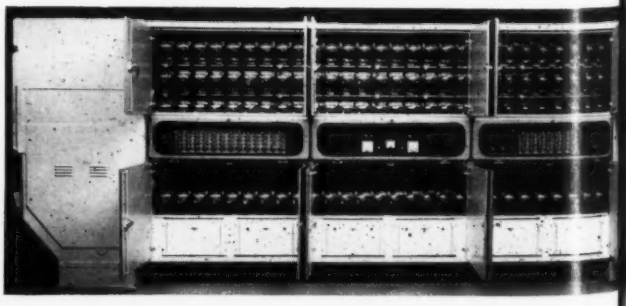
The instant that a letter is despatched from the synchronising timing device, its corresponding code previously stored in an information storage or memory device is electronically translated and, simultaneously selective mechanisms throughout the machine are pre-set to ensure correct routing of the letter to its appropriate destination box.

Letter conveying is by means of a series of rubber-tyred idler wheels sprung down against rubber driven conveyor rolls. The selecting mechanisms consist of memory units which, at exactly the right times, mechanically trigger diverter blades which route the letters, firstly into their correct rows, then into their correct destination boxes.

The new letter sorting machine has a high degree of inbuilt flexibility. This enables one to vary the location of destination boxes corresponding to given codes, so that 'easy' keyboard combinations correspond to 'heavy' loadings and the physical layout of destination corresponds to the required pattern of distribution. The point is that inward sorting of letters presents different problems to outward sorting, and further problems are presented by special rush seasons such as the Christmas post or the rush of football pool letters on a Monday morning from pool promoters to the public. It is therefore necessary, on occasion, to vary the arrangement of the destination boxes, to double-up certain boxes, to eliminate others, and to introduce new destinations altogether. This implies altering the relationship between the keyboard code and the destination box order.

Two methods of rendering the code system highly flexible are employed. Firstly, as previously mentioned there are four possible variations in the relationship of keyboard code to destination box order. The destination label holders may be indexed into any one of four positions and the wiring relationships altered by changing over a component known as a switch-over plug or patch-board plug. There are four of these plugs in a storage cupboard and the appropriate one can be inserted in a few seconds. When the label holders have been correctly indexed to suit the patch-board plug in use, and indicator light signals, showing that the correct selection has been made. The system is

Fig. 5a. Back of the new machine with panel doors opened, showing location of electronic packs, memory wheels, etc. within the three centre units. There is a fifth row of memory wheels behind the electronic consoles in the centre units.



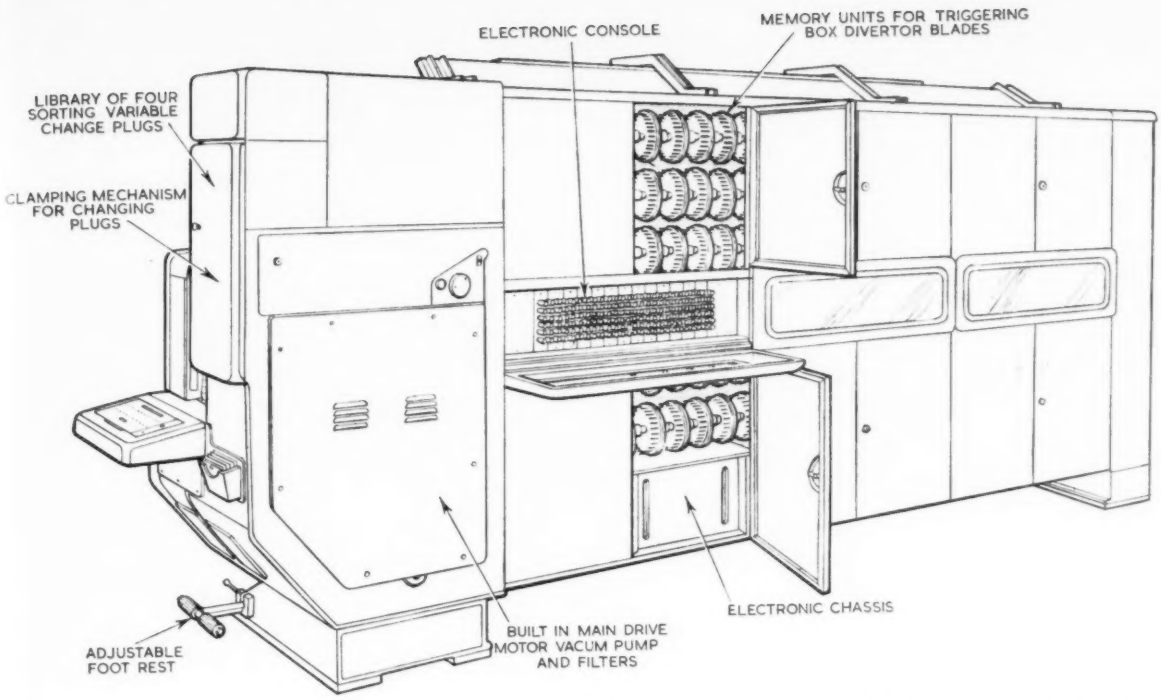


Fig. 5b. Diagram of the new machine showing some of the electrical, electronic and memory equipment.

interlocked to prevent machine operation if the destination labels are not set to correspond to the code plug in use. This code plug is actually a pre-set switching system which connects the keyboard codes and the destination boxes according to a carefully-worked-out pattern.

The second method of obtaining flexibility is by arranging the electronic system so that the code plugs can be wired together to group numbers of boxes to serve chosen destinations, letters for those destinations being distributed over the groups and not delivered to single boxes. This feature is of particular value where the loading is heavy on a particular destination.

A number of safety features have been built into the machine. A letter which is too thick or too stiff to handle by the conveyor system is automatically rejected by a special device in the presentation unit. Any letter which jams in the conveyor system will automatically stop the machine. In either case the machine will stop and a trouble indicator on an alarm panel will light up, showing the operator the point of stoppage. Jammed letters are easily extracted from the conveyor system by means of simple conveyor idler throw-off devices. These take all pressure off the conveyor system and ensure extraction of jammed letters without risk of damage.

Operator safety has been taken care of by incorporating adequate machine guarding, this being of transparent material where necessary, in order to permit visual inspection of letters in transit. All electric and electronic components are accessible, but only by opening locked doors, the keys of which are not available to operators.

In addition to start and emergency stop buttons, there is a normal stop button, which causes the machine to deliver all letters in transit before coming to standstill. A photo-cell counter totals all letters passing into the machine. And, to permit subsequent tracing of any particular operator, each man has a simple disc, which is inserted into a built-in printing device, which prints a small identification mark on each letter. Fluorescent lighting is built-into the presentation unit, and it also is provided on the destination box side of the machine. This enables a machine to be entirely independent of room lighting. Lubrication is by automatic pump circulating system. Sintered bronze oil-impregnated bushes, where used, are provided with supplementary oil reservoirs, and where advantageous, ball races are used.

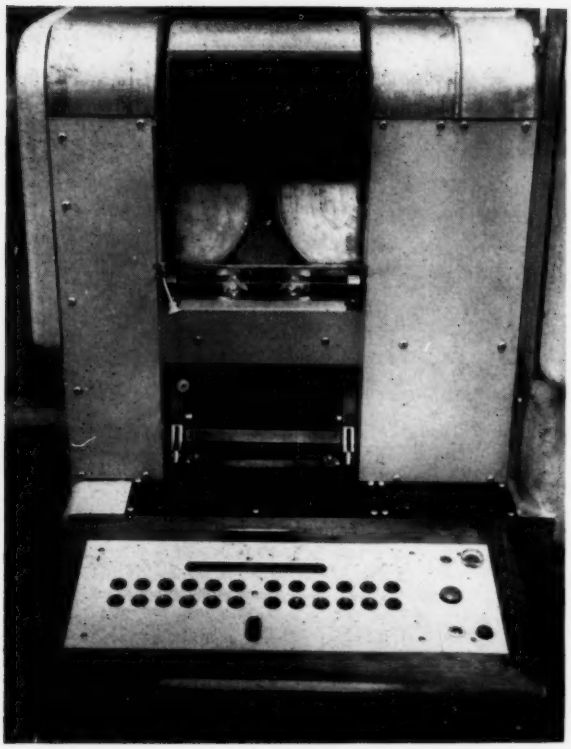
Unit assembly design has been used to permit quick replacement of components. The electronic system is designed for simple testing, and there are spare chassis assemblies in the machine, for quick switch-over, should this be necessary.

The machine is constructed in five major assemblies, and can be transported as a single unit or as five separate units, according to space and floor-load restrictions. Jacking trolley wheel bogies may be fitted, making the machine readily transportable for movement from one position to another. And, as can be seen from the illustrations, although the main aim of the G.P.O. and the manufacturers has been to achieve performance targets, functional design has been successfully combined with a pleasing contemporary appearance. The overall size is as follows: length 17 ft; height 7 ft 6 in; width 3 ft 6 in; total weight is 3 tons. There are two electric motors, a main motor of $3\frac{1}{3}$ h.p. and a mail feed motor of $\frac{1}{8}$ h.p. Maximum letter size is $7\frac{1}{4}$ in $\times$ $5\frac{1}{2}$ in $\times$ $\frac{5}{16}$ in. Larger letters will be handled by machines now under consideration.

Main differences between Prototype and Production machines

The main differences between the Dollis Hill prototype letter sorting machine and the Bristol-made production model are due to improvements, some of which were asked for by the General Post Office, others being developed by The Thrissell Engineering Co., Ltd. and Electronic Instruments, Ltd., in close association with G.P.O. Engineers.

After becoming familiar with the G.P.O. requirements, H. Osborn, Thrissell's chief designer, went to Southampton sorting office and worked days and nights with the machine, studying its operation and observing any snags and difficulties which might arise. A group of six Thrissell design engineers followed him at various times and did likewise, each of them concentrating on one aspect or another of the



Figs. 6 and 7. Front view of presentation unit, showing operator's keyboard, double view windows, and alarm panel for pin-pointing location of mail blockage due to the presence of an excessibely thick or excessively stiff letter. Fig. 6 shows the twin helix mechanism behind the upper viewing window. Fig. 7 shows letters passing through the machine.

prototype machine's design, construction and operation. The prototype machine was then sent to the Bristol factory of the firm, where it was studied for six weeks during normal and abnormal operation. It was, for example, run at above normal speed, in order to study performance under limiting conditions. This experience enabled the designers of the production machine to establish design criteria and was very helpful in forming a basis for the final production design.

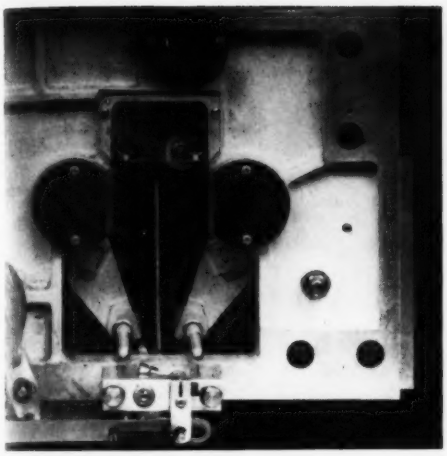
The improvements built-into the final production model are too numerous to list in detail, let alone discuss, in this report. The most important of them are as follows:—

(1) Precautions to enhance the safety of live mail when it is being mechanically handled.
(2) Precautions to enhance operator safety.
(3) Facilities to permit rapid change-over of faulty components or sub-assemblies.
(4) Facilities to improve the accuracy of sorting.
(5) Higher maximum keying speed.
(6) Facilities to detect thick and excessively stiff letters, prior to their entry into the conveying system proper.
(7) Simplification of the information storage system.
(8) Increased information storage capacity.
(9) A lengthened anticipation feature to permit short bursts of high speed by the operator.
(10) Improved control layout.
(11) Completely visible letter conveying system.
(12) Re-arranged location of letter feed, this being one level higher than previously.
(13) Provision of letter pick-up device within easy reach of operator and always fully visible to him.
(14) Use of computor-type plug board system to permit programme variation.
(15) Four-position sorting, instead of two-position sorting.
(16) Reduced heat losses by replacing thyratrons by cold cathode valves.
(17) Elimination of micro-switches where possible.
(18) Use of one single-revolution clutch in driving mechanism, instead of a number of single-revolution clutches and a number of micro-switches.
(19) Provision of complete interlocking facilities, where necessary.
(20) Improved mechanical drive system.
(21) Automatic oil lubrication instead of manual grease lubrication.
(22) Unit construction for easy handling during transit.
(23) Built-in fluorescent lighting.

Floor loading and transit requirements

The Thrissell British Post Office Letter Sorting Machine may be regarded as a typical conveyorised processing machine, the overall size, weight and arrangement being determined by processing requirements. The problem often encountered when conveyorised processing machines and machine tools are being transported, is that of handling ability in transit and floor loading *en route* and on site. The Post Office prototype machine, for example, is a single indivisible unit and special precautions are necessary when moving it from sorting office to sorting office, from sorting office to laboratory, etc. Quite apart from its structural and functional integrity, the driving mechanism is such as to render splitting of the machine very awkward, if not impossible, without re-designing.

The production machine employs a form of construction which easily permits splitting into component self-contained units. There are five of these, each consisting of equipment mounted within a separate structural frame, suitable for independent handling. It must be remembered that functionally speaking, there is no real breakup of the



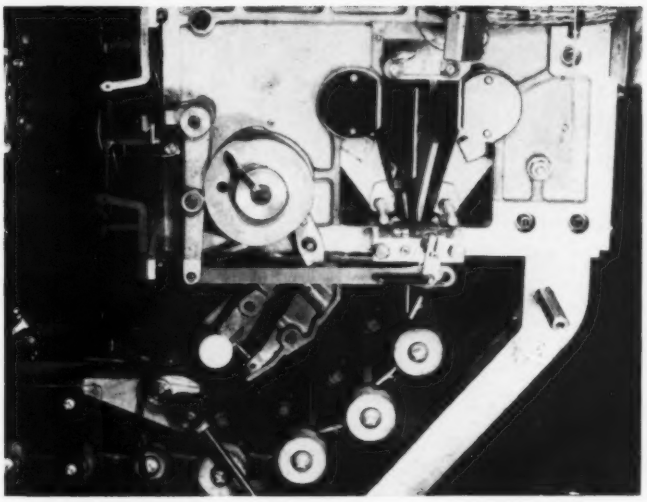


Fig. 8a. *End-view of new twin waiting or phasing gate mechanism, showing oscillating gate in centre of opening.*

Fig. 8b. *Close-up view of twin waiting or phasing gate, showing one letter in the waiting position (right), and a second letter leaving the gate (left) and about to enter the feed conveyor rolls.*

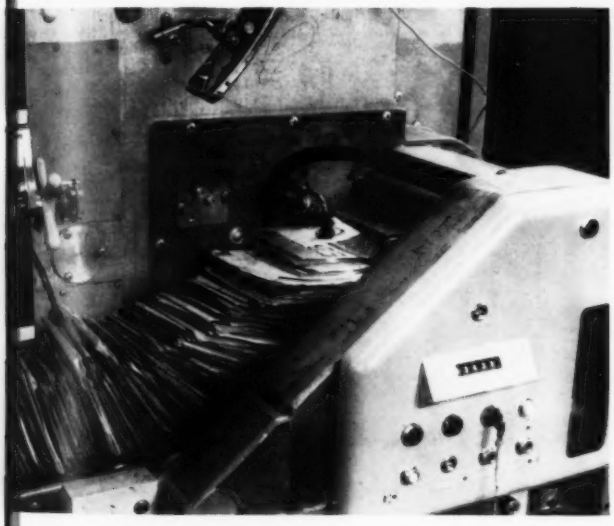


Fig. 9. *Inclined letter conveyor showing a letter on the vacuum picker device, which is designed to ensure that only one letter is fed into the presentation unit at a time. This pick-up mechanism is now covered by a Perspex guard and fully accessible to be within easy reach of the operator. He can stand up, lift the guard, and reach over if the picker misses a letter or is not picking up properly due to bad stacking of letters in the letter feed reservoir.*

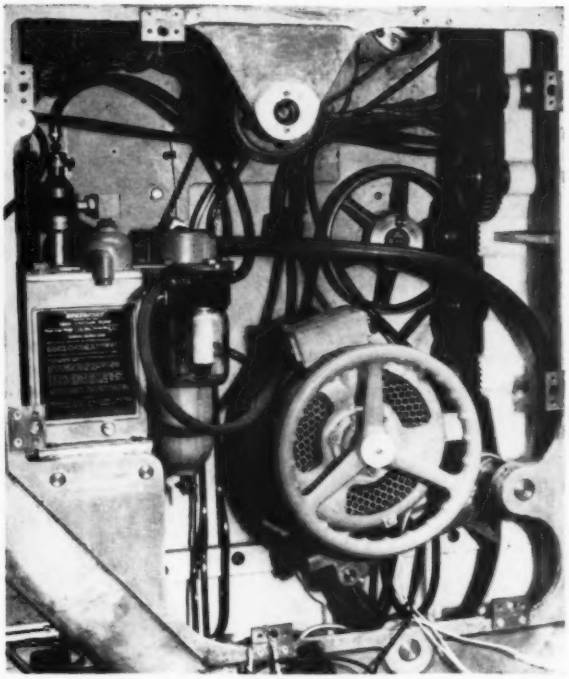


Fig. 10. *Main drive mechanism, which is now more compact, with all parts in one casting. The whole of the drive mechanism and the vacuum pump mechanism, is now easily accessible on removal of a single guard, thus simplifying maintenance. On the prototype machine the rotating memory wheels were driven by a gearing system. On the production machine a long two-piece driving chain is employed.*

machine into separate functional components along its length. The letter conveyors for example, have to be almost continuous from end to end. A continuous destination box control system is required, together with its associated memory system equipment, switching arrangements, etc. Nevertheless, the designers did succeed in sub-dividing the machine. This was done, mainly, by so designing the mechanical drive system as to permit it to split at certain points, making use of chain transmission between all five units and by arranging for corresponding splitting points in the electric control and electronic systems. It is not possible, in this report, to discuss exactly how this was achieved. It is sufficient to note that it was achieved and that the problems solved were so complex as to render relatively simple, the problems of splitting many of the apparently complex, large and awkward pieces of conveyorised processing equipment which mechanical handling, transport and erection engineers are only too familiar with.

Each of the five main assemblies of the production machine can be carried in a medium-sized electric lift. These

Fig. 11. Three-quarter view of machine from rear or diverter end, showing general arrangement of feed conveyor rolls and elevator rolls

sections are shown in Fig. 5a, and are the following, the presentation unit, which incorporates one of two supporting pedestals, the vertical distributor or diverter unit at the rear end, which also incorporates a supporting pedestal, and three similar intermediate units. If necessary, due to space restrictions, the supporting pedestals attached to the end units can also be readily detached. As can be seen from Fig. 5a, the three intermediate units shown with their rear-side doors open, each incorporate memory wheel equipment at all five conveyor levels, these being for triggering the box diverter blades, i.e. switching letters into destination boxes on the other side of the machine. Four sets of memory wheels are visible in the photograph. The fifth set is just behind the electronic control consoles at conveyor No. 2 level. The centre compartments contain electronic control equipment, and the lower compartments contain further electronic equipment. All electronic equipment is designed to be removed in complete units for servicing or changing. The front sides each incorporate destination boxes, letter conveyors, and associated control equipment.

Sometimes an assembled machine has to be moved from point to point within its working area, or from part of a building to another. The letter sorting machine, for example, may have to be moved from one part of a large sorting office to another, and it is convenient to be able to do so without splitting it up and re-assembling. For this reason provision is made for fixing two under-carriage units, each consisting of a frame carrying a pair of castor wheels mounted on screw jacks. Operation of the jacks lifts the pedestal bases clear of the ground. The jacks are clearly shown in Figs. 1, 2, 4 and 5b. In recently erected sorting offices, e.g. at Norwich, the letter sorting machines are run in on steel plates laid on top of the asphalt-topped concrete floor.

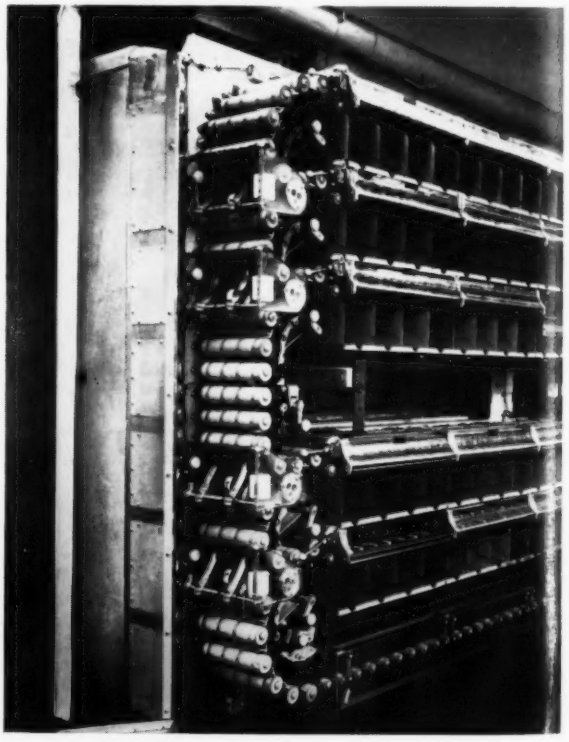
Permissible floor loadings in most sorting offices are 112 lb/ft² or thereabouts, which is somewhat lower than that called for in modern workshops designed for light industry, which is more generally 150 lb/ft² or a little more than this. The floor loading was considerably reduced by making use of light alloys for all main castings and other lightweight materials for components where practicable. The completed machine has a total weight of about 3 tons. Taking into account the spacing of adjacent machines, when more than one machine is in use in a sorting office, as will be the case, this gives a floor loading well within the requirements.

Safety of Mechanically Handled Live Mail

In order to improve the safety factor when handling live mail changes were made to the letter conveying system to enable jammed letters to be easily removed, and in addition, a thick letter detector has been added to the machine. The thick letter detector is mounted in the presentation unit and this operates an alarm signal on the alarm board over the top viewing window (Figs. 6 and 7) if a letter of greater thickness than $\frac{1}{8}$ in. is presented, or if the letter is too stiff to pass through a predetermined conveyor radius. Letters which are too thick or too stiff, or which contain bulky objects liable to tear the envelope during mechanical sorting, such as keys and coins, are in this way isolated and removed from the machine. The operator simply lifts the alarm panel and removes the letter in question from behind it.

Despite this initial precaution, letters may jam within the conveyor system. Further safety features are therefore built into the machine. The conveying system employs trains of driven rollers, each associated with its own sprung idling rollers. Letters are carried forward between consecutive pairs of rollers. The idling rollers are assembled in pairs on spindles riveted to flat spring-steel strips and held in the closed position by control handles, as shown in Figs. 11, 12, 13 and 14. If jamming occurs, the idling rollers at that point cease to rotate, a jamming detector device indicates the location of the trouble on the alarm board over the top viewing window (Figs. 6 and 7), and the machine comes to a standstill. Operation of the corresponding throw-off lever enables the operator to extract the jammed letter without difficulty and without danger of tearage. Figs. 13 and 14 show the mode of operation of

Fig. 12. Close-up view of diverter unit at rear end of machine, showing arrangement of idlers in groups, each of which may be thrown-off independently to enable jammed letters to be extracted without difficulty or tearage.



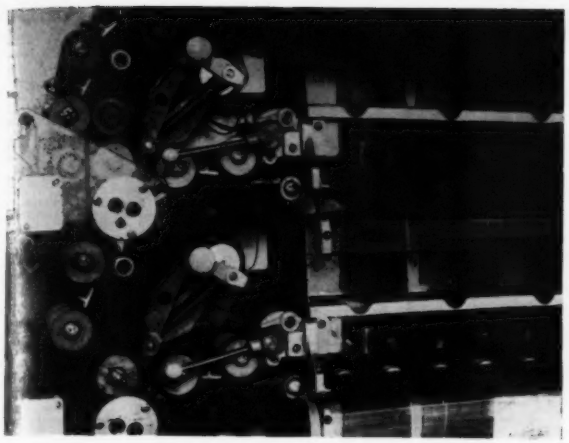


Fig. 13. ***Close-up view of banks of idlers*** *of diverter mechanism, shown in released or thrown-off position, to permit extraction of jammed letters. Operation is by means of knob-ended handles shown. Each handle frees the idlers or tread rollers throughout one horizontal level of conveyor and in a corresponding bank of diverter rolls.*

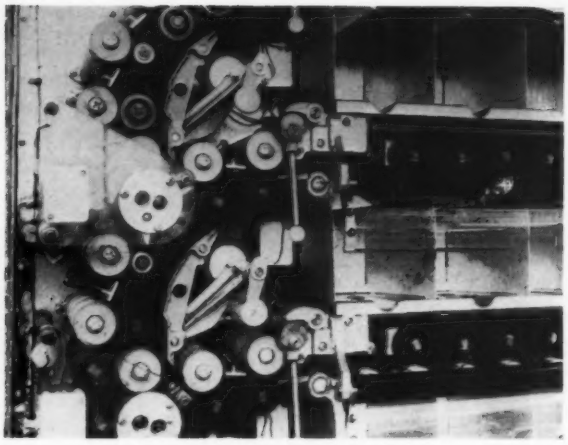


Fig. 14. *Close up view of banks of diverter idlers, shown in closed or driving position, each being in contact with its respective driving roller. It will be seen that the throw-off control handles are in the down position and that the idlers or tread rollers of the horizontal conveyors are also in contact with their respective driving rollers. (Compare with Fig.* 13)

Fig. 15a. *Close-up view of tread rollers (idlers) of horizontal conveyors, showing detector units wire-up to condenser packs in background. Light and simple detector units are now employed, instead of the original centrifugal switches. On the prototype machine there was one detector unit to every six tread rollers. On the production machine there is one to every second roller*

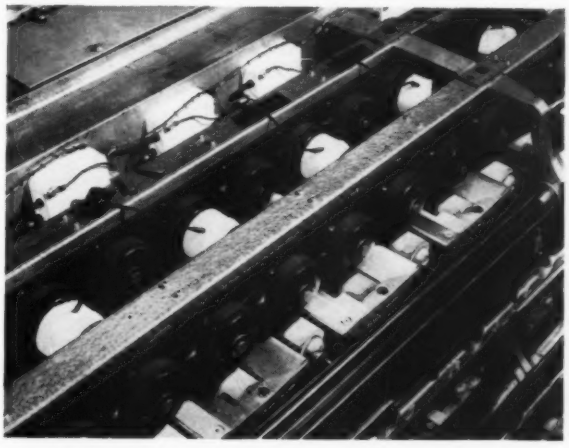
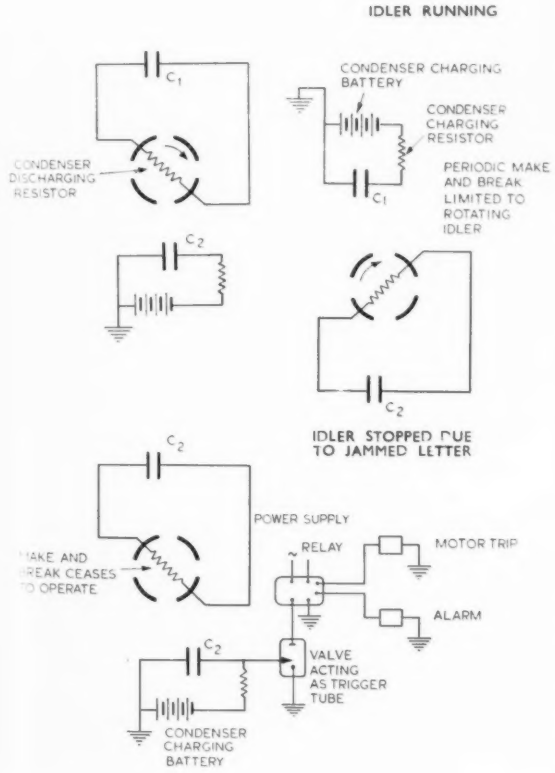


Fig. 15b. *Principle of operation of letter jamming detection device.*



throw-off handles. This precaution is built into the horizontal conveyor runs as well as the vertical distributors and diverters.

The idler jamming detection method employed on the production machine is shown in Fig. 15a. This makes use of pairs of detectors as described below. On the prototype machine every sixth idler incorporated a centrifugally-operated detection device. When running, the weights fly out and open an electrical contact coupled to an alarm circuit which is coupled to the motor control system. With this arrangement, very short letters might jam without detection. Furthermore, there is some time lag in detection, and sensitivity, although quite good, is not of the instantaneous inertia-free type, as is possible with purely electrical methods.

On the production model of the letter sorting machine, idler rotation detectors are built into every second idler, thus ensuring that the very shortest of letters and postcards handled will be detected should jamming occur.

The detecting method employed is shown in principle in Fig. 15b. Each idler in question incorporates a periodic make-and-break switch, wired to a pair of condensers. Each condenser is alternately open-circuited and discharged by this make-and-break switch, as long as the idler continues

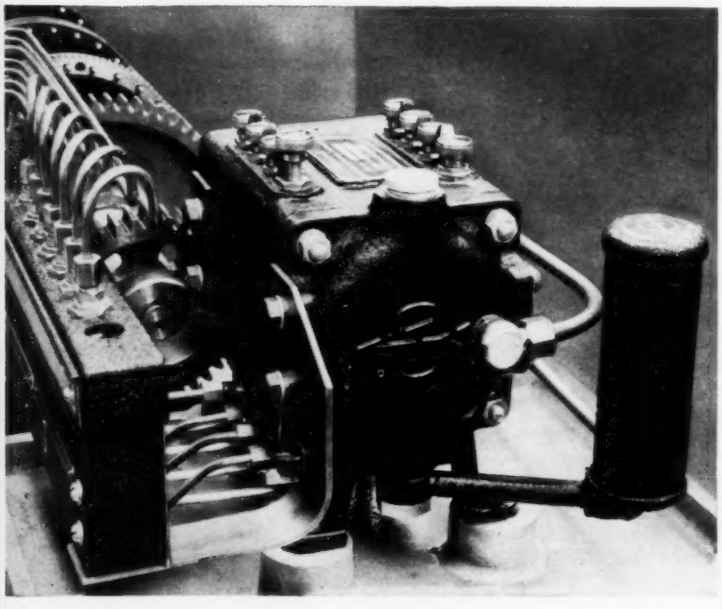
to rotate. Now, as each condenser is open-circuited by the make-and-break switch, through another circuit, it is charged up. If the idler stops, one of the two condensers will be open-circuited by the make-and-break switch, it will steadily charge up through the charging circuit, and then it will discharge through a firing circuit, this setting in motion a train of electrically-controlled events which include operation of the corresponding alarm and shutting down of the machine. There is a very short time lag to cover transient effects, but for practical purposes, stoppage detection due to jamming and operation of the alarm and shut-down controls may be regarded as instantaneous.

Improved Accuracy of Sorting

The complex inter-action of the various design factors and performance requirements is well illustrated by changes made in order to improve sorting accuracy. The pin disc type of mechanical information storage is essentially periodic in character: information can be registered only at cyclic points in time when a pin is correctly positioned in relation to a setting solenoid. This synchronous characteristic has to be linked with a random speed operating rate at the keyboard, limited by a random rate of feed of letters through the viewing windows and an overall maximum frequency of throughput. The synchronous and random speed parts of the machine must therefore be matched by an information-delaying device, to enable information to be fed from the asynchronous part of the machine at synchronous speed. One difficulty is the danger of any one letter catching up and 'pick-a-backing' on to the one ahead during this delay period.

On the prototype machine this difficulty was in general overcome, very rare exceptions being cases which were approaching the limit, i.e. maximum sized letters being delayed for a maximum time, by running the synchronous part of the machine at a very much faster rate than the random speed or asynchronous part of the machine, something like 50 per cent faster. This, however, meant running letter conveyors at a higher speed than was strictly required for purely handling purposes. For comparison purposes the conveyor speeds of both machines can be reckoned identical whilst the letter acceptance speed of the production machine is up by approximately 17 per cent—from 94 to 110 letters/min.!.

Fig. 16. *Automatic lubricating oil pump which supplies a drip feed to the totally enclosed driving chains of the letter sorting machine. The prototype machine was grease lubricated, most of the driving mechanism being exposed.*



In the production machine the letter conveyors are not speeded-up in this fashion and the difficulty is overcome by incorporating a twin waiting or phasing gate which synchronises the letter release as shown in Figs. 8a and 8b. Letters are alternately fed to opposite sides of the gate and are released alternately at machine time, thus two letters may be in the gate at the same time,i.e. one each side. This system in effect gives double the time for synchronising the letter to that used on the prototype machine, the operational advantages being (*a*) improved accuracy of sorting, and (*b*) increased machine handling capacity.

If the two sides of the double waiting gate are called *A* and *B*, the events which occur are as follows: the first letter is keyed and fed into side *A* of the gate, where it waits until the next keying action, which feeds the second letter into side *B* and prepares side *A* for opening at the next pin-setting opportunity. The third keying action feeds a third letter into the now empty side *A* of the gate and prepares side *B* to release the second letter at the next pin-setting opportunity, etc.

Each letter in turn, therefore, pauses for the remainder of its keying interval and for any synchronising delay. This pause allows the operator to cancel errors in coding, if he realises that they have been made. Cancelling can take place at any time up to commencement of the next keying action, which is sufficient for remedial action to be taken. In this way accuracy of sorting is improved slightly. One minor problem with the prototype machine was due to the fact that an operator had to be fairly quick in order to cancel a realised mistake, because keyed letters went on their way at once without further delay.

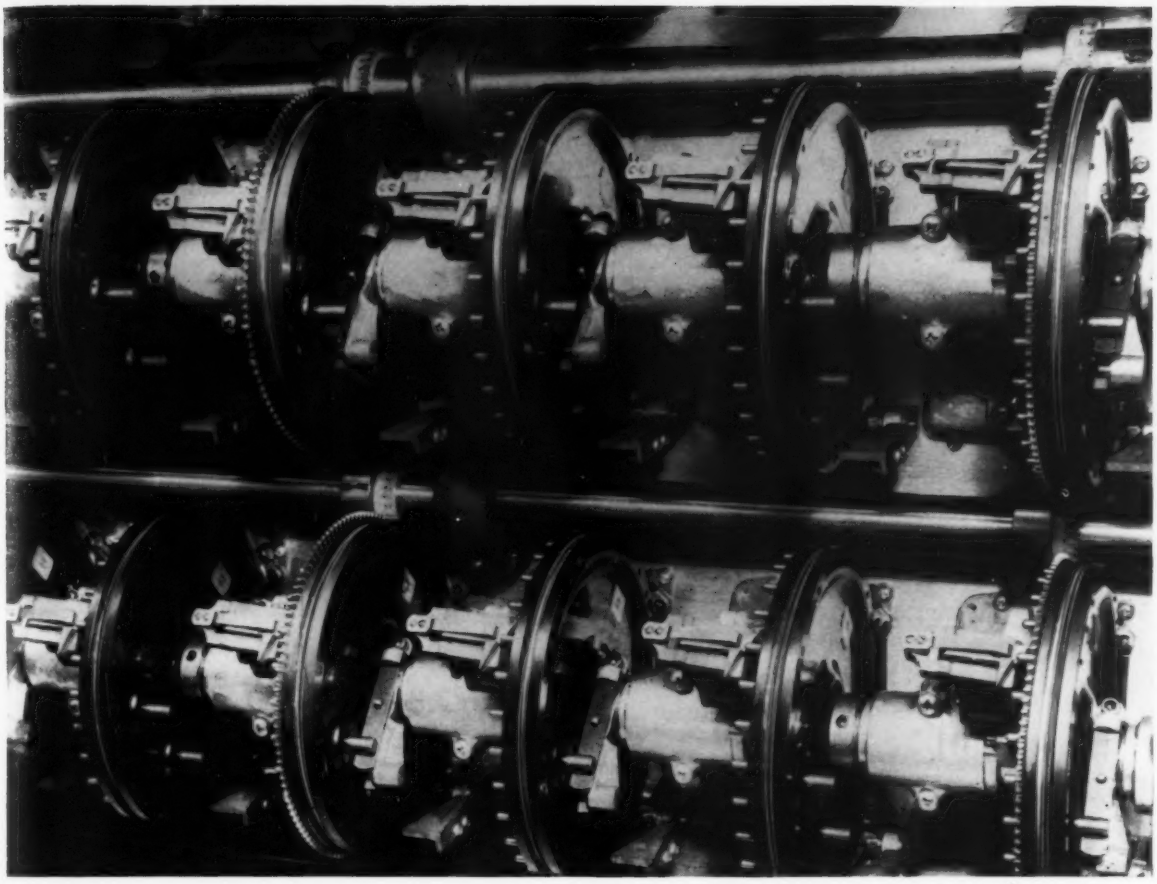
The double phasing gate enables synchronous speed and presentation unit speed to be identical at 110 cycles/min. In other words, at 110 letters/min, individual letters pass through the gate, on the average, at the same speed as entry speed, there being no resulting delay in handling rate. Because of this the handling capacity of the letter sorting machine has been increased from 94 to 110 letters/min.

The increased speed was called for by the General Post Office because experience with the prototpye letter sorting machine has shown that its speed, 94 letters/min, was too slow for a fast operator working with an easily recognised sample of mail, and occasionally led to irritating frustration. A speed of 110 letters/min appears to correspond much more closely to the rate of working achieved by trained letter sorting machine operators during short bursts of high speed keying under these conditions.

A further improvement built into the new letter sorting machine is an increased anticipation feature, specially called for in the General Post Office's specification. If an operator sees two letters in sequence addressed to the same destination, due to the reduced thinking time, he will probably tend to code them rather faster than normal maximum operating speed (110 letters/min). To enable him to do so, additional electronic information storage facilities have been provided, to enable a second letter in any two in series, to be coded *and the information stored* whilst the mechanical operations resulting from the first coding are still in progress. The extra electronic storage can be considered as the equivalent of a surge tank or temporary store, its function being to temporarily hold information arriving at above maximum average performance input rate.

Improved Information Storage Facilities

When designing the prototype letter sorting machine the Post Office development engineers at first intended to provide a purely mechanical information storage or memory system, mainly to provide a simple solution to the problem of linking the memory system to the diverter blades employed



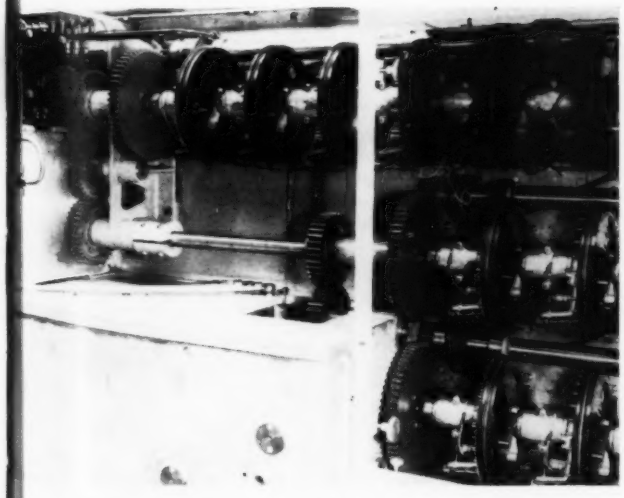


Fig. 17. Close-up view of co-axial arrangement of memory wheels on production machine. There is one wheel per destination box, each combining the functions of the destination box and primary memory wheels of the prototype machine. There are also four conveyor level diverter memory wheels.

Fig. 18. Driving mechanism of memory wheel systems. The discs are grouped in threes, the first of each group being driven via large-diameter spur gear meshing with a common layshaft, the remaining wheels of the group being driven tandem-fashion from the first by engaging radial arms, spring-loaded to eliminate back-lash.

to route the letters to their correct destination boxes. Thus, in addition to storing information, the mechanical memory system would act as a switching system, the storage elements being used to actuate the diverter blades as well as store information.

Experimental and theoretical considerations soon showed that a purely mechanical memory and switching system appeared to be an extremely difficult proposition. For this reason a compromise two-stage system was adopted, comprising an initial electronic information storage system and a mechanical system.

The first stage system is designed to accept the operator's signals as they are produced, i.e. at a random timing. These signals are released and fed into a mechanical memory system at a predetermined speed, i.e. synchronous speed. This is necessary because the mechanical memory system employs rotating discs, each with a ring of deflectable pins near its periphery, speed of rotation being constant, as is the linear speed of the letter conveyors. The information read from the deflected pins is then decoded in a translator stage, comprising a 12 by 12 field of thyratrons. The entire system was fully described and illustrated in previous articles in *Mechanical Handling*.

When developing the production model of the letter sorting machine, the Thrissell-Electronic Instrument-G.P.O. design teams took the opportunity to re-design the entire control system, including the memory system. The main aims of the improvements made were as follows: (*a*) to simplify the memory system, (*b*) to increase information storage capacity, (*c*) to improve general reliability of the machine.

The use of pin discs as the basic time-delay elements was retained, as was the principle of using a 12 × 12 field of valves for translating signals from the mechanical

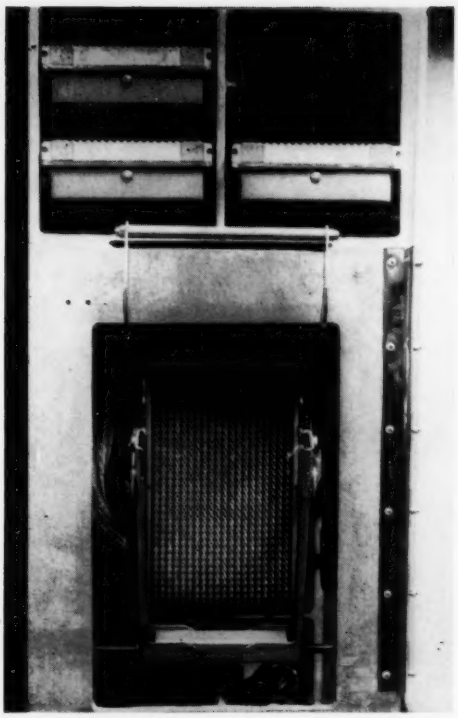
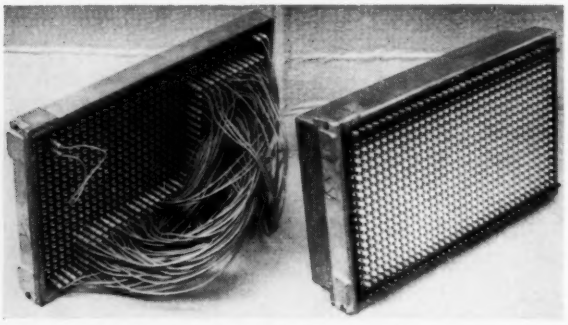


Fig. 19. Programme unit with patch board plug removed, showing acceptance points or gates for plug board, and storage for extra plug boards above. This has 600 different outlet connections and is used to link the keyboard with the destination boxes.

Fig. 20. (Right) Patch board plug. (Left) Back of patch board plug with cover removed. The bottom five rows of plugs correspond to the physical layout of the five rows of destination boxes on the letter sorting machine and are, in fact, from the information outlet side of the board. The square area of plugs to the top right of the board corresponds to the 12 × 12 matrix of cold cathode tubes, and forms the information inlet side of the board. This particular board is for use where multiple grouping of boxes is not necessary. For box grouping, as when arranging for heavy loads for particular distributions, use would also be made of some of the plug sockets shown unused in the photograph.



memory system. In the prototype machine there was a primary mechanical memory, and linked with the outputs of the field of thyratrons, a second stage mechanical memory, which also operated diverter blades at the various destination boxes. In the production machine the primary mechanical memory has been entirely eliminated, thereby saving a considerable amount of valuable space and simplifying the electronic and mechanical design of the machine.

In the production machine the box memory units, there are no others, are arranged co-axially with one another, as shown in Figs. 17 and 18. This arrangement enables the box memory wheel diameters to be made large enough to memorise the complete time storage required. One result of this is the moving of the phasing trap from a point near the rear end of the machine, as it is on the prototype, to the double waiting gate in the presentation unit, as described below. It is also of interest to note that the required information storage capacity of the production machine exceeds that of the prototype. Thus, in the prototype machine there are 132 destination boxes, some of which function as overflow boxes for heavy traffic. In the production machine there are now 144 destination boxes plus 5 overflow boxes, thus permitting full exploitation of the 12 keys of the keyboard and their 144 possible code combinations.

On the prototype machine the axes of the second stage or local box-memory pin discs are arranged perpendicular to the machine length, thus restricting their diameter and preventing them from being able to memorise a signal of the full length. For this reason a primary or main memory system became necessary.

On the production machine two mechanical memory systems are therefore combined into one, the functions of the individual memory wheels, one per box, and those of the 12-wide banks of primary memory wheels, now enabling one single memory wheel per box to function in one step, aided by four sets of memory wheels for conveyor level selection. In addition to simplified mechanical design, this improvement simplifies electronic control and greatly reduced the numbers of valves required.

The new arrangement greatly improves access to the pin discs for servicing purposes, and simplifies removal of faulty discs. The discs are grouped in threes for driving purposes, the first disc of each group being driven through an $\frac{1}{8}$-in wide large-diameter spur gear meshing with a nylon pinion on a stiff common layshaft, the remaining two discs being driven tandem-fashion by engaging radial arms, spring-loaded to avoid backlash.

Each pin disc has a central steel boss and a moulded bakelite disc with graphite content. Needle roller memory pins are used, located in the outer rim of the disc. There are facilities for angular adjustment of a disc relative to its associated diverter actuating cam, and for angular adjustment of a pin-setting solenoids relative to the disc. The pin-setting times and the control of the associated information stores are controlled by four pulses, generated by electro-magnetic induction from permanent magnets cemented into the rims of adjustable timing wheels.

Other important improvements made in the design of the control and memory systems were as follows: (*a*) elimination of micro-switches for pulse production, (*b*) replacement of thyratrons in the translation matrix by cold cathode valves.

In the prototype machine micro-switches were used to synchronise the phasing or waiting gate, and to translate the code from the memory pin wheels to the trigger tubes, i.e. to the thyratrons. Micro-switches are known to have a very long working life, about 16 million cycles, but the General Post Office engineers who prepared the specification for the production machine, felt that there was still some risk in using micro switches, particularly in view of the fact that in the prototype machine 24 micro-switches were used in the memory system alone, some of them operating at 120 cycles/min. For this reason, on the production machine all micro-switches have been eliminated and replaced by four rotating magnets, which trigger-off 'flip-flop' two-circuit valves, and thus pulses are produced as required without mechanical wear occurring.

On the prototype machine there were no less than 144 thyratrons in each of the two banks. Appreciable heat was developed, the power consumption being thereby increased, and there was some risk of wiring insulation being damaged. On the production machine simplified design has enabled the two banks of tubes to be reduced to one, and, by making use of cold cathode tubes, power consumption, heating and danger of 'cooked' wire insulation, have been greatly reduced.

MODERN CONVEYING INSTALLATION FOR RAW SUGAR

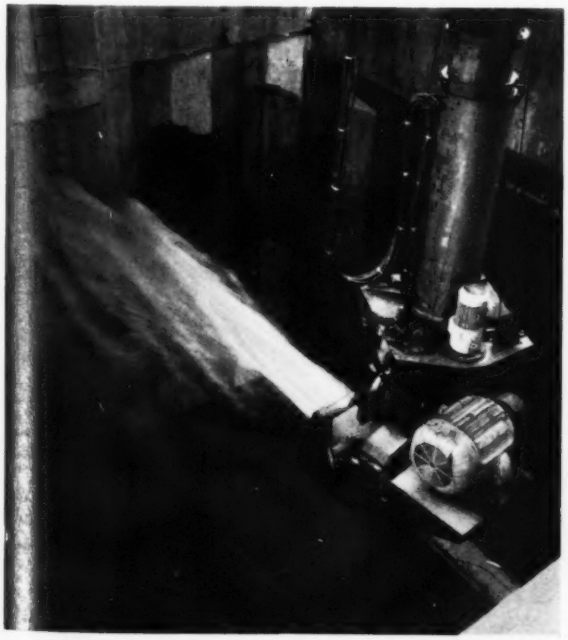
IN MOST COUNTRIES, the conveying of material in bulk has become common practice. Besides such materials as sand, gravel, cement and coal, materials for human consumption, such as grain, oil seeds and recently flour are being conveyed en masse. Storage in bulk allows better control of the merchandise involved and eliminates contamination to a great extent.

Since 1950 bulk handling has also come to the raw sugar industry. In the different countries of the world, the production of cane and beet sugar exceeds 30 million tons annually. Reference to raw sugar in the following pages, means cane sugar which grows in tropical and sub-tropical regions. The diameter of the canes can be as much as 1·6 to 1·9 in (40 to 50 mm) and they can be up to 16 to 20 ft (5 to 6 m) long. Out of these canes raw sugar is produced according to the process described below.

The cane passes first through one or two preliminary cutters in which it is cut and crushed into small pieces. The material then runs through three to six roller mills; each mill has three rolls which often have a size up to six or more tons. The juice running out of these mills is subsequently cleaned by adding calcium in lumps for limewater. The mixture is then heated to a boiling temperature and pumped into tanks where the sediment in the fluid has the opportunity to sink to the bottom. The residue is heated again and sulphuric acid is added. After this process the material is cleaned by a filter process. The resulting juice is added to the clear liquid. The liquid is than put through an evaporating process, mostly done through a vacuum, until a thick syrup results. This syrup is further concentrated by cooking in vacuum cookers and is afterwards crystallized. The required size of crystals is obtained by adding sugar to the crystallization process. After that, the crystallized syrup is brought into cooling troughs in which is is constantly stirred. From here it gets into the centrifuges, which separate the liquid from the solids. From these centrifuges, two different materials are thus obtained: (*a*) the liquid syrup which is then further desugared; (*b*) the raw sugar.

Inside view of a sugar warehouse. The raw sugar continuously flows from the Buhler chain conveyor which is installed into the roof supports

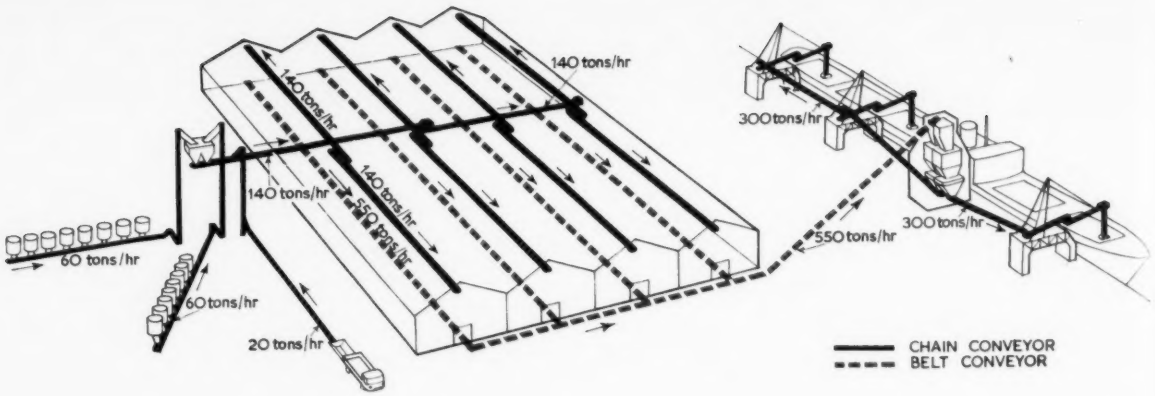
Action photo of the ship trimmer, capacity 300 tons; throwing distance 30 m is up to 98 ft.



The general definition of raw sugar is approximately the following:

96-97	per cent sugar (saccharose)
1·2	per cent non-sugar solids
0·8	per cent ash (various salts)
1·0	per cent water
100	per cent total.

Its colour varies generally from brown to light yellow. Each sugar crystal has more or less a thick coating of syrup. This syrup contains mostly the various ashes and non-sugar solids because, as shown above, most of the saccharose has been removed from the initial syrup. To obtain pure white sugar, this syrup coating has to be



Schematic layout of the raw sugar storing, warehouse and ship loading

removed and to do this, the crystals are washed with water or steam in a process which is called affination. In most cases, pure white sugar is obtained by the refining process. The sugar is dissolved in water and the solution cleaned by means of decolouration coal and finally filtered. By means of cooking and further crystallizing, the normal refined sugar such as used in households is obtained.

Raw sugar is only a half-finished product. It is brought to the refiners and from there to the market for human consumption. Previously, the raw sugar leaving the centrifuges was generally sacked in 220-lb (100-kg) bags and then stored on pallets by means of fork trucks, belt conveyors, etc. As most of the raw sugar producing countries are in the tropical zone, the greatest part of the produced raw sugar has to be shipped to the refineries in Europe, U.S.A., Japan, etc. The raw sugar bags were generally loaded by hand from the storage warehouses on to railroad cars or trucks and thus brought to the loading pier. By means of cranes, the bags were then loaded into the ship hatches. At the ships destinations, the process was reversed to get the sugar to the refineries. As it takes about 100,000 raw sugar bags to fill a 10,000-ton liberty freighter, refineries all over the world now require the shipping of the raw sugar in bulk thus making it possible to unload the sugar by means of clam shell buckets and further handle it by means of bulk conveying systems directly to the warehouses of the big refineries.

The first step in this direction taken by the raw sugar

General view of the ship loading installation on the dock

Loading of a 10,000 *ton vessel in* 20 *hrs*

exporters was that the raw sugar bags were brought to the pier where they were cut open and their contents dumped into the ships hatches. During the last few years the sugar exporters have found that further great savings could be achieved by conveying the sugar in bulk directly from the centrifuges to the warehouses, by storing the raw sugar in bulk and furthermore by conveying it in bulk from the warehouses to the ship hatches.

Last year Buhler Brothers, Uzwil, Switzerland did some pioneer work, through the installation of a large bulk sugar conveying system at the Azucarera Haina in the Dominican Republic. The Rio Haina plant is one of the largest raw sugar producing concerns in the world with a yearly production of approximately 200,000 tons which is about the total sugar consumption of the whole of Switzerland in one year. Parallel to the new raw sugar installation, the sugar warehouses were modernized and new high-efficiency and high capacity automatically working sugar centrifuges were installed so that to-day this plant is one of the most modern in the world.

Two Buhler chain conveyors bring the sugar from each row of centrifuges to the two vertical bucket elevators with a capacity of 60 tons/hr. Next, the sugar of each production line is automatically weighed. Two further conveyors in series above the roofs of the warehouse distribute the raw sugar within the building. Each warehouse has a length of 426 ft (130 m). The sugar is distributed inside each warehouse by means of one conveyor each from the centre to the left side and from the centre to the right side. The conveyors are supported by the existing roof construction.

In order to allow other, smaller raw sugar manufacturers to use the modern ship loading equipment, a separate truck dump was installed which allows the other producers to insert their sugar into the new conveying system. A truck scale takes care of the weighing.

For the reclaiming from each of the four warehouses, which have a total capacity of 78,000 tons, a belt conveyor was installed into the centre of each warehouse. The belts are covered with removable aluminium profiles. By removing one of these covers, the raw sugar flows automatically onto the belt. The remaining sugar is fed to these belt conveyors by means of payloaders or bulldozers. A specially constructed movable chain conveyor dosing device prohibits overloading of the draw-off belts and guarantees a constant peak capacity of 550 ton/hr. A further belt conveyor, installed at right angle outside the warehouses, brings the raw sugar to the weighing tower on the shipping pier. Within this tower two raw sugar tipping scales of special construction guarantee an accuracy of 1 per cent. From the weighing tower the raw sugar is distributed in two parallel streams to the three stationary ship loading units. These are engineered in such a way that two of them alone are able to transfer the whole capacity of 550 tons/hr to the ships hatches. The correct spacing of these loading towers called for special studies as it was necessary to load many various types of ships without having to move the latter. The moving arm which reaches over the ship's deck contains another totally enclosed Buhler chain conveyor in order to prevent any soilage of the ship's deck. This moving loading arm can be pivoted by 180 deg and can furthermore be lowered or raised. At the outlet of this ship loading conveyor a vertical telescopic chute brings the sugar to a ship trimmer which is attached at the lower end of the telescopic chute. Each ship trimmer can handle 300 tons/hr and throw the raw sugar up to distances of 98 ft (30 m). Without one man handling a single shovel it is thus possible to load all corners of every ship's hatch. The whole loading operation is done by remote control from a panel board installed in each loading tower. It can furthermore be checked from a centrally located panel board at the weighing tower. Intercom systems as well as optical and acoustical devices are provided for communication between the various operating centres.

The whole installation was taken into operation the beginning of this year and high average loading capacities of up to 500 tons/hr have been reached. This means that a 10,000 ton liberty vessel can leave the port after only 20 hr berthing time. It took five to eight days to load such a vessel when the bag method was in use.

MATERIALS HANDLING, PLANT LAYOUT AND WORK CONTROL IN A SMALL WORKSHOP

By P. C. MacCULLOCH*

"Traditionally, the Toolsmiths' Shop has been thought not to lend itself to any form of flow process in layout of operations or work."

THE ABOVE QUOTATION is taken from a report made by a company of management and industrial consultants to a client company's management.

Fitzpatrick & Sons (Contractors), Ltd., the civil engineering company, transferred in 1957 their Toolsmiths' Shop from their Head Office site in Old Ford, London, to their depot at Edmonton.

The history of the investigation into the methods of operation which resulted in the proposal to move to Edmonton, the complete re-layout of the shop and the introduction of new methods and control of work, is the subject of this article.

Historical Background

The Toolsmiths' Shop was initially set up at Old Ford by Fitzpatrick's in order to provide facilities for the repair of chisels, compressor steels, pick axes, line pins, etc., and a variety of stone masons' tools used by their company's workers. Subsequently, this service was extended to other contractors and the manufacture of new tools. Over a period of some 10 years the turnover of work substantially increased, new equipment was introduced, a collection/delivery van put on to regular sales routes and, at the time of this investigation, the staff comprised of a manager of the Shop, one office clerk responsible for all clerical duties, a van driver and mate, six toolsmiths and one shop foreman.

Conditions in the workshop at Old Ford, as can be seen from the photographs Figs. 1, 2 and 3, were cramped in the extreme, in fact two new machines had not been introduced on to the shop floor because of the congestion. The Company's policy was to promote the activities providing a tool sharpening, repair and manufacture service and considered it necessary that the capacity of the toolsmiths' shop should be capable of 100 per cent increase on existing production. The company was prepared to invest in new machinery and also there was available, at the Edmonton depot, a building which could be adapted for the use of the toolsmiths.

Before making any final decision on the move, the company asked their consultants to make a survey of the existing layout of the shop and the methods and control of work, and to present detailed proposals for improvement so that the company could make a realistic assessment of the advantages, if any, of moving to Edmonton and to obtain the best possible return from any outlay of capital and re-layout of the machines, etc., necessitated by such a transfer.

Survey of Existing Conditions

After a short survey of the physical amenities of the existing shop, it became apparent that facilities for the expansion of the physical requirements of the toolsmiths' at Old Ford were non-existent. The area of some 1,500 sq. ft. had been fully utilized and, although some changes of layout and improved methods of working could be introduced, the results would not justify the work involved, neither would they allow for the 100 per cent increase in production capacity that the company desired.

On the other hand, the shop available at the Edmonton depot, with a clear area of 2,800 sq. ft. in the main workshop and ample side offices, would give the opportunity for the introduction of an efficient layout of machines and improved methods of handling and also allow for a 100 per cent increase in production tools and staff when this latter development was considered desirable.

The work of the consultants was then directed towards evaluating the balance of the work between the various operations of repairing or sharpening contractors' and stone masons' tools, in order that the best physical relationship between the operations could be determined and a new layout of machines designed.

A brief description of the items of plant involved and the method of working at Old Ford will enable the reader to follow the subsequent steps of the investigation more clearly.

Each evening the collection/delivery van returned to Old Ford, and the tools that had been collected that day were off loaded by hand. The tools varied greatly in length, diameter, shape and weight (some 70 types of standard tools form the bulk of the toolsmiths' work). The manner in which these tools were delivered left much to be desired. An assortment of buckets, sacks, boxes and loose bundles of tools were dumped on the floor of the shop, the customers name marked, in chalk, on one tool of a batch, being the only means of identification. The range of tools had been divided into three main divisions, each toolsmith specializing in the sharpening of tools within a particular division, e.g., Small Tools, Compressor Steels and Heavy Tools (pick axe heads, line pins, etc.) The day's collection was separated by the van driver and his mate into these three main groups and placed on the floor adjacent to the relevant smith's area.

A list of customers and their tools was given to the office clerk by the van driver, the clerk then made out the invoice/delivery note set from this information.

* L. W. Bailey & Partners, Ltd.

Fig. 1. *Conditions at Old Ford site*

Fig. 2. *Conditions at Old Ford site*

Fig. 3. *Conditions at Old Ford site*

Fig. 4. *Toolsmith's work places at Old Ford site*

Fig. 5. *Compressor steel smith's work place at Old Ford site*

Each smith, unless he was directed to do otherwise, worked through the batch of tools that had been laid alongside his work area. If no customers' work was available he requested further work from the shop manager, and would be directed either to assist another smith or instructed to manufacture new tools for stock purposes. Each smith filled in a daily work sheet giving the customers' name, type and number of tools worked on, and any 'daywork' he had performed. This was collected each morning and a new sheet issued by the office clerk, who then computed the man's earnings (piece rates were then in operation) for the day—summarizing these sheets each week and informing the wages department of the amount to be paid. The method of invoicing, etc., and the computation of earnings was quite satisfactory, it was in relation to the control of work from the van to the smith and on to the van again that gave cause for concern. Examples of the effects of this lack of control were:

Orders could be processed out of priority.

Individual smith's time was being haphazardly utilized.

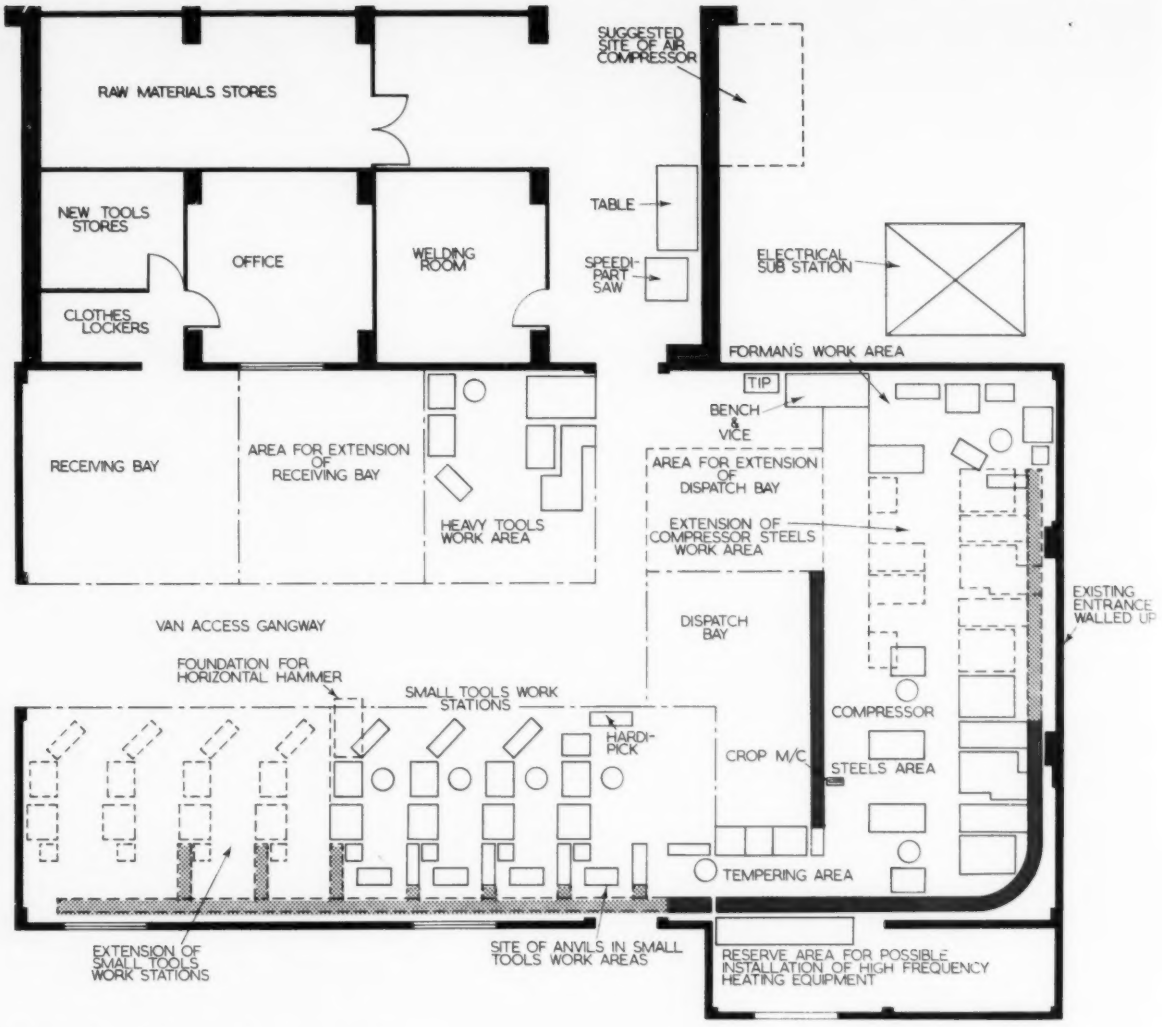


Fig. 6. Layout of new toolsmith shop at Edmonton

Customers' names and orders were being unnecessarily publicized.

Discrepancies only became apparent at a time when memories and a physical check on the shop floor had to be resorted to.

Loss of identity of part, or the whole, of an order.

The extension of loading and unloading times.

With regard to the unnecessary publication of customers' names, it is of interest to note that, in the past, an enterprizing smith had become so familiar with a particular customer's tools and name that he left Fitzpatrick's and set up as a toolsmith on his own, taking this customer's work, and that of others with him.

The work involved in sharpening tools, which forms the bulk of the smith's work, consists of four distinct operations:

(*a*) Heating, by means of a gas muffle, the tool to a malleable temperature (four or more could be heated simultaneously).

(*b*) Shaping the heated tool by means of a pneumatic hammer or by hand, using a hammer and anvil.

(*c*) Grinding the shaped tool to the requisite smoothness and sharpness, dependent on the type of tool.

(*d*) Tempering, by gas muffle and quenching tanks (oil or water).

Thus the three smiths working on small tools each had within his working area—a gas muffle, a pneumatic hammer and an anvil, a pneumatically operated single-end grinder, a water tank and an oil tank, see Fig. 4.

The two smiths specializing in Compressor Steels each had one gas muffle, a water tank and an oil tank, but they shared a large pneumatic Holman hammer and one small grinder. They also had access to a large electrically driven grinder, see Fig. 5. The one smith engaged on Heavy Tools had available one large gas muffle, a Goliath hammer and had access to the large electrically driven grinder used by the Compressor Steel smiths.

Other items of equipment that were available for special purposes (mainly used by the shop foreman) were one gas muffle, three pneumatic hammers, three grinders, welding equipment and a hand-operated cropping machine.

Some angle-iron racking for holding finished tools was available but because of lack of room was not used. The only means of moving tools other than individually, by hand, was in buckets, sacks or wheel barrow.

The consultants decided that an 'activity sampling' exercise would quickly, and within the degree of accuracy required, show up the proportion of the toolsmiths' time devoted to the various activities within the shop. This would provide a factual gauge of the effectiveness of productive time of the smiths and show where improvements could be made in the methods of work and layout of the shop.

In accordance with the consultants' normal practice in work of this nature, a notice addressed to the smiths was prominently displayed in the shop explaining the reasons for the observation study and they were invited to make any queries they might wish. In the event at no time was there any trouble with the men during the investigation or after the implementation of the proposals.

The 'activity sample' covered one week's normal working hours and some 1,300 valid observations were made of the smiths' activities in that time. At each observation the work that each smith was doing at the precise moment of observation was recorded under one of 11 headings.

Results of Survey

The result of the exercise showing the proportion of the smiths' time given to the various activities is given below:—

Preparing to start work	2 %
Using tools and equipment	57 %
Walking between equipment	3 %
Waiting to use equipment	6½ %
Giving or receiving instruction	2 %
Fetching and sorting work	4½ %
Putting away finished work	2 %
Filling in time sheets	2 %
Cleaning and tidying up	1 %
Personal time in shop	16 %
Personal time away from shop	3 %
	99 %

The results pinpointed those activities which were worth considering individually to discover if the proportion of time spent on them was unnecessarily high or unproductive with the ultimate intention of:—

(*a*) eliminating them if they proved to be unnecessary, or

(*b*) restricting them to a smaller proportion of the total time to the advantage of more productive activities, or

(*c*) considering if they could be usefully rearranged in the work cycle to the overall benefit of the productive capacity of the shop.

Under (*a*) (elimination) the activities of 'walking between equipment' (3 per cent) and 'waiting to use equipment' (6½ per cent) were the subject of further study. It was found that by encouraging the Small Tool smiths to the use of their individual grinders and removing the temptation to use the big grinder, most of the walking time could be eliminated. The time spent in waiting occurred at the tempering operation when the smith was idle while waiting for his sharpened, ground tools to heat up before quenching.

The possibility of divorcing all tempering activities from the previous operation, and making this work the responsibility of one man was investigated and found to be feasible, thus concentrating the activities of the toolsmiths on the work of shaping and grinding.

Under (*b*) (restriction) the 57 per cent of the toolsmith's time in using equipment was broken down into the proportion of time spent on particular pieces of plant. It was found that 15 per cent of the total time was spent in using the anvil for hand shaping. This was queried with the manager and he gave his considered opinion that the smiths were 'afraid' of using the fast stroke pneumatic hammers and thus tended to fall back on hand methods. In the light of this it was proposed that the use of the power hammers should be encouraged and the anvils removed from the immediate vicinity of the toolsmiths' work areas.

Finally, under (*c*) (rearrangement of operations) it was found worth while and practicable to reallocate the tempering process (8 per cent), the operations of fetching and

Fig. 7. Mobile trollies used for tote box movement within the new shop at Edmonton

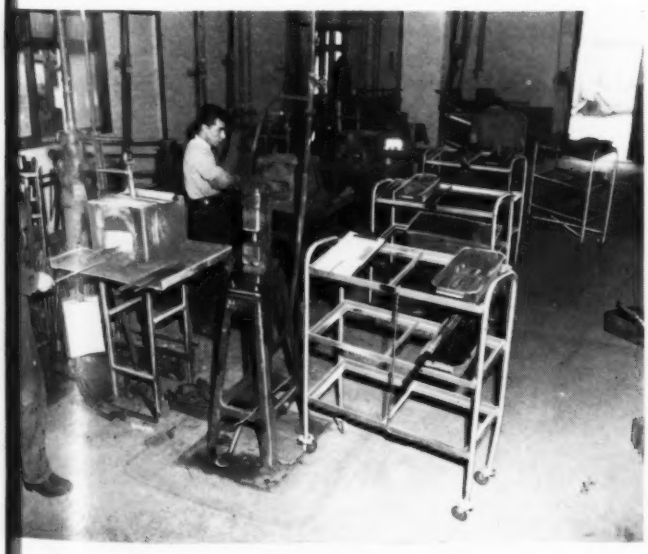


Fig. 8. Compressor steel Smith's work place at Edmonton showing gravity roller conveyor at rear

sorting work (4½ per cent), and the operations of putting away finished work (2 per cent).

In all it was considered that a minimum of 30 per cent of the toolsmiths' existing work could be reduced by the above adjustments of operations and functions and the elimination of time spent in waiting and walking. Thus 30 per cent of the existing productive capacity was available to take on more work without adding one extra toolsmith.

Layout Proposals

Fig. 6 shows the layout proposed for the new toolsmith shop at Edmonton which was accepted and is now installed.

From this it will be noted that clearly defined areas have been allocated to:

(*a*) The receipt of goods—provision being made for the van to enter the shop and unload alongside the receiving bay.

(*b*) Three separate work areas for—
The Small Tools smiths.
The Compressor Steels smiths.
The Heavy Tools smiths.

(*c*) A central Tempering area to which tools from the Small Tools and the Compressor Steel smiths' areas are directed.

(*d*) A dispatch bay adjacent to the last production process, tempering, and where the delivery van can load direct, thus reducing the movement of finished work.

(*e*) A Foreman's work area for experimental and special items.

(*f*) Raw Material Stores, materials cutting and welding area, are available with a separate entrance.

(*g*) Offices, cloakrooms and finished goods store.

The dotted outlines indicate the areas for expansion and these will allow for the introduction of another six toolsmiths and their equipment when this is considered desirable.

Materials Handling Proposals

Careful consideration was given to the means of handling the tools throughout the various operations in the shop and to the methods to be introduced for the control of the collection of tools and allocation of work to the toolsmiths.

After some experiments and an exhaustive study of the average sizes of customers' orders, it was agreed to standardize containers for the collection of tools and their movement within the shop.

Two sizes of 14-gauge steel tote boxes were experimented with under working conditions and these were ordered in quantities of 200 size 16 × 8 × 3¾ in and 150 size 25 × 10 × 4 in. These numbers allowed for one week's work in the shop at any one time, plus a full load on the van.

Mobile trolleys, see Fig. 7, were ordered so that full tote boxes could be easily moved to the various work areas. It was agreed that four of these trolleys would be required for each Small Tools smith and two trolleys for each Compressor Steels smith.

Consideration was given to the advantages of providing gravity roller conveyor for the transfer of sharpened tools from the Small Tools and the Compressor Steels work areas to the Central Tempering area. In the event it was considered that, at this level of staff and work, roller conveyor should only be provided from the Compressor Steels work area (see Fig. 8), their work being more standardized in respect of the type of tool, and the weights involved being considerably heavier—up to 1 cwt per tote box.

Proposed New Methods of Working and Control

The method of working in the new shop is as follows:—

The van loaded with tote boxes full of tools, each tote box being identified with a fibre tag bearing the customer's name, delivers resharpened tools and collects tools during the day. When collecting orders, the driver puts the customer's tools in the requisite number of tote boxes, filling each box to capacity and placing a fibre name tag in each box. He records on a Tool Collection form, see Fig. 9, the number of tools collected, the customer's name and address, and the total number of boxes allocated to that customer, irrespective of the type of tools contained in them.

On returning to Edmonton, the driver, his mate and the shop labourer unload all the tote boxes and stack them in customer groups in the receiving bay. The driver then passes his Tool Collection form to the office clerk and moves his van to the dispatch area for loading.

The office clerk, by means of the Tool Collection form, allocates each type of customer's tools to particular toolsmiths using the Work Allocation form, see Fig. 10, noting the customer's name, date issued, order number, quantity and description of tools, internal code number (for financial and costing purposes) the toolsmith's name and any special instructions. The Work Allocation form is then passed to the shop labourer.

The shop labourer sorts by type the tools of each customer and puts each batch of types into one or more tote boxes. He then puts into each tote box a numbered metal disc and records this number against the toolsmith's name on the Work Allocation form. He also records the total number of boxes given to holding the customer's complete order. It will be appreciated that this figure of the number of boxes containing a particular customer's order in the shop will not necessarily tally with the figure of the total number of boxes collected from the customer, as recorded on the Tool Collection form. The reason being that the tote boxes in the shop carry a batch of one particular type of tool (and there are cases where this batch comprises only three or four separate tools) whereas on collection and delivery all one customer's tools are placed in the smallest number of boxes possible, irrespective of the type of tool, in order to make the best use of the van's load-carrying capacity.

After sorting the tools into types and recording the disc numbers the labourer loads a trolley with tote boxes of tools to be processed by the toolsmith designated on the Work Allocation form and moves this loaded trolley to the workplace of the particular toolsmith, as circumstances of work demand.

The toolsmiths each have a Toolsmith's Daily Sheet, Fig. 11, issued each morning from the office, the previous day's sheets being collected by the clerk at the same time.

On receiving a trolley load of tote boxes with tools, the toolsmith records on his Daily Sheet the number of the disc contained in the box of tools he is going to work on. The column headed 'Batch Quantities' enables the smith to record individual tools or batches from the box—entering the final total of a particular type of tool in the adjacent 'Total' column. This is all the clerical work demanded of the smiths and this procedure is also applicable to the man responsible for tempering all tools.

Thus the flow of work for the Small Tools smiths is that of lifting tools from tote boxes loaded on trolleys from his right-hand side, heating, forging and grinding the tool on his gas muffle, power hammer and grinder respectively and putting the forged tool into an empty box on a trolley stationed on the left of his work area. He also transfers the relevant numbered disc to the new tote box on his left.

As trolleys, loaded with forged tools, become full the shop labourer moves these down to the tempering area. Here the smith responsible for tempering enters his Daily Sheet in the same fashion. He then transfers each box to the gravity roller conveyor positioned in front of the

Fig. 9. Tool collection form

TOOL SHARPENING ORDER FORM | DATE | ORDER No. 2004

CUSTOMER'S NAME & ADDRESS | TOTAL No. OF BOXES | FRITZPATRICK & SONS (CONTRACTORS) LTD, TOOL SHARPENING DEPT., EDMONTON, TELEPHONE No.

GRANITE TOOLS	QUAN.	MARBLE & SOFTSTONE TOOLS	QUAN.	BRICK TOOLS	QUAN.	CONTRACTORS TOOLS	QUAN.
AXES		BITS		BOLSTERS		ASPHALTE CUTTERS	
PAVING BOLSTERS		BOLSTERS		BRICK RAKES		BEDDING HAMMERS	
ETC.		ETC.		ETC.		ETC.	
				LETTER CUTTING ETC	QUAN.		
				CARVERS CLAWS			
				" GOUGES			
				ETC.			
				COMPRESSOR TOOLS	QUAN.		
				ASPHALTE CUTTERS			
				FEATHERS			
				ETC.			

SPECIAL TOOLS AND/OR REMARKS

SIGNATURE

These documents to be filled in by van driver

WORK IDENTITY CARD | ORD No.

CUSTOMER'S NAME

DATE

Fig. 10. (below) Toolsmith's work allocation form

Total number of work boxes and identity disc nos entered on form by workshop labourer

TOOLSMITH'S WORK ALLOCATION FORM | DATE ISSUED | ORDER No.

CUSTOMER'S NAME | DATE COMPLETED | TOTAL No. OF BOXES

QUAN.	DESCRIPTION OF TOOLS	CODE No.	TOOLSMITH'S NAME	BOX IDENTITY DISC NUMBERS

Fig. 11. (below) Toolsmith's daily sheet

TOOLSMITH'S DAILY SHEET | DATE

NAME:

BOX No.	BOX No.	BOX No.	CODE No.	BATCH QUANTITIES	TOTAL	PRICE	£	$	D

NOTED _____ MANAGER

TOTAL ADDITIONS HOURS @

Box nos. of sharpened or tempered orders to be entered by the tradesman concerned

Fig. 12. *Tempering area at Edmonton*

tempering gas muffle, see Fig. 12. As each box is emptied he transfers it to the end of the dispatch bay roller conveyor alongside the quenching tanks ready to receive the finished tools. On the completion of the tempering process, the boxes of tools, still carrying their identity discs, are allowed to run down to the end of this latter conveyor into the middle of the dispatch bay where they are removed and stacked in this area by the shop labourer.

The shop labourer, before the arrival of the van in the late afternoon, receives from the office the delivery/advice note sets for each customer and the relevant Work Allocation forms. From the latter forms he checks the identity discs in the boxes of finished tools against the customers' names and puts all one customer's tools into the minimum number of boxes as will contain them. In this case the number of boxes should tally with the number recorded on the Tool Collection form. In each box he places the relevant customer's name tag ready for loading on the van.

The van driver and his mate assist the labourer to load the van which can be backed right up to the dispatch area.

Summary of Advantages Gained

The main advantages gained by the installation of the new layout and the institution of the new control procedures can be summarized as follows:—

1. The productive capacity of the existing personnel and machines has been increased by at least 30 per cent because of:—

(*a*) The centralization of tempering work in one area. This has afforded the opportunity for a greater degree of control over this critical process and allows for the convenient introduction of high-frequency induction heating equipment for the tempering process should this prove desirable. It also removes the need for the Small Tools and Compressor Steels smiths to have quenching tanks in their work areas, allows their gas muffles to be used for forge heating only and concentrates each man's skill where it can be most effective.

(*b*) The supply of a sufficient number of tote boxes, allowing one week's total throughput of orders to be handled in the most convenient manner for purposes of identification, control and ease of handling.

(*c*) The supply of a sufficient number of mobile trolleys to carry tote boxes—reducing the physical labour of moving tools to and from work areas and assisting in ensuring a constant flow of work to the toolsmiths.

(*d*) The installation of gravity roller conveyor between the Compressor Steels smiths' work area and the tempering area allowing sharpened tools to be easily and rapidly moved away from the toolsmiths and assisting in providing a continuous flow of work to the tempering area.

(*e*) The installation of gravity roller conveyor from the tempering area to the dispatch area ensuring that finished work can be immediately moved out of a production area to where it can be conveniently sorted for dispatch purpose.

(*f*) The appointment of one general labourer to handle tote boxes and mobile trolleys throughout the work cycle, i.e., feeding the toolsmiths' and tempering area with work, unloading and sorting incoming orders and assembling and loading finished work.

(*g*) The removal of the large Goliath hammer and the large electrical grinder from the immediate vicinity of the Small Tools work area serving to encourage the individual smith to a greater use of the pneumatic hammer and grinders provided.

(*h*) The ability of supervision to quickly and accurately identify and control all work in the shop by means of numbered metal discs—on the van by fibre name tags—in the office by the new Tool Collection and Work Allocation forms and the redesigned Toolsmiths Daily Sheet.

2. The introduction of new machines and extra personnel to increase the overall production capacity of the shop can be effected at any time without upsetting the new layout at Edmonton or interfering with current production because:—

(*a*) The siting of the main production areas is such that expansion of these areas can be made at either end in at present clear floor areas—see Fig. 6. This expansion can be made to the extent of 100 per cent on existing numbers of personnel and machines.

(*b*) The materials handling facilities of tote boxes, trolleys and roller conveyor are highly flexible in their use and thus can be readily re-arranged or additions made to them to suit any increase in volume of work or expansion of the work areas.

(*c*) The siting of the machines requiring some depth of foundation, e.g., pneumatic hammers, is such that even in doubling the equipment, no alteration needs to be made to the position of the existing machines.

(*d*) The introduction of more formal documentary control ensures that the administration of the Toolsmith's shop is able to cope with a considerable increased volume of orders efficiently.

The cost for the materials handling equipment, i.e., tote boxes, mobile trolleys and roller conveyor did not amount to £500 in total. The smaller tote boxes, the trolleys and the roller conveyors were supplied by Messrs. W. C. Youngman, Ltd., from their standard range of equipment. The larger tote boxes were supplied by Messrs. Fisher & Ludlow, Ltd.

The above results serve to emphasise the contention that a methodical study, using quite sophisticated techniques of analysis concerning ways and means of improving the utilization of plant and labour, can be applied, with substantial advantage, to comparatively small enterprises.

The size of the Toolsmiths' Shop, compared to the main activities of Fitzpatrick's Civil Engineering work, is very small. Nonetheless the company's management considered it 'common sense' to ensure that, small as it is, this facet of their business should be planned with the same care as they would apply to any of their major road contracts.

J. M. BESKING, B.Sc.(Eng.)

MATERIALS HANDLING AT A MODERN INLAND POWER STATION

PART TWO: HANDLING OF RAIL-BORNE COAL SUPPLIES—(Continued)

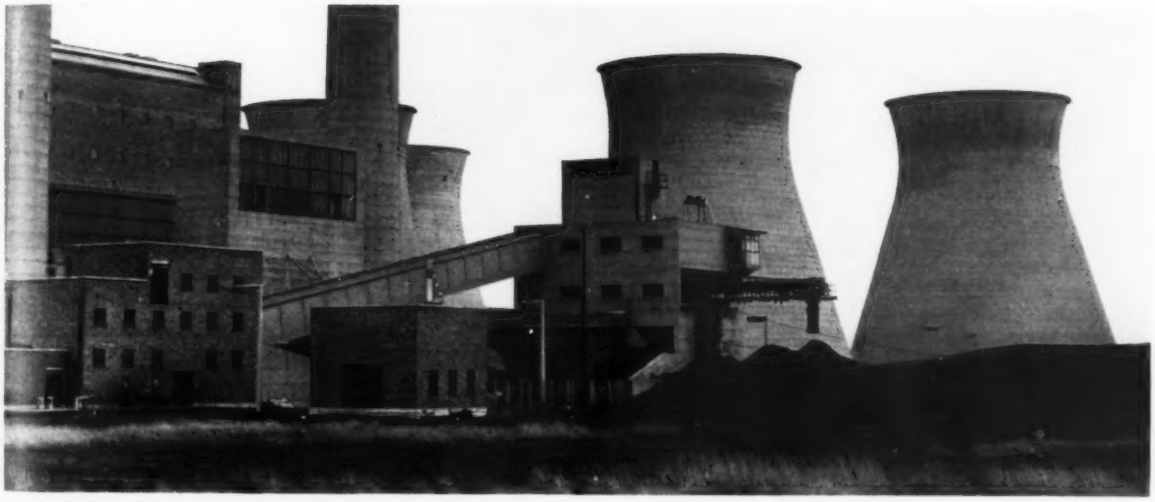


Fig. 15. *General view of stockpile, stocking-out conveyor, drag scraper control room, tippler house, and junction house with No. 2 feeder conveyor between, within inclined gantry. Note boiler house in the rear, behind dust bunker house*

Fig. 16. *View of combined junction house and automatic weighbridge house, with gantries of Nos. 2 and 7 conveyors, seen from a window of the combined tippler and stocking-out conveyor tower*

SUPERFICIALLY it is probably true to claim that there is very little difference in principle between the coal handling plant of a modern inland power station, such as Goldington Power Station, Bedford, and the coaling plants of veteran power stations still steaming to-day, such as Croydon 'A'. Wagon tipplers, belt conveyors, gravity bucket elevators, drag scrapers, and bunkers designed to gravity-feed mechanically stoked boilers, have been in use for well over half a century. In fact, considering handling in its wider sense, the only truly revolutionary advance in power station handling during the twentieth century has been the complete abandonment of manual stoking of coal-fired boilers and, with it, the complete mechanization of boiler ash removal.*

Actually, there is a vast difference between the coal-handling plants of coal-burning power stations commissioned during the last few years, say from 1948-49 to the present day, and those commissioned during 1923-38. Generally speaking, one can say that the best practice of pre-1939 is the normally accepted practice of recently

**Editor's Comment:* The author of this report is, of course, well known to readers of *Mechanical Handling*, having contributed articles and reports for more than 12 years. Readers may therefore be interested to learn that he started his professional career as an electrical engineer at the City Road Station of the old County of London Electric Supply Co., Ltd. In those days, *not so very long ago*, the rapid growth of Barking Power Station had enabled the much older generating plant at City Road to be shut down and a short time before Mr. Beskine commenced work at City Road, large-scale *manual* stoking and *manual* ashing had been normal practice there.

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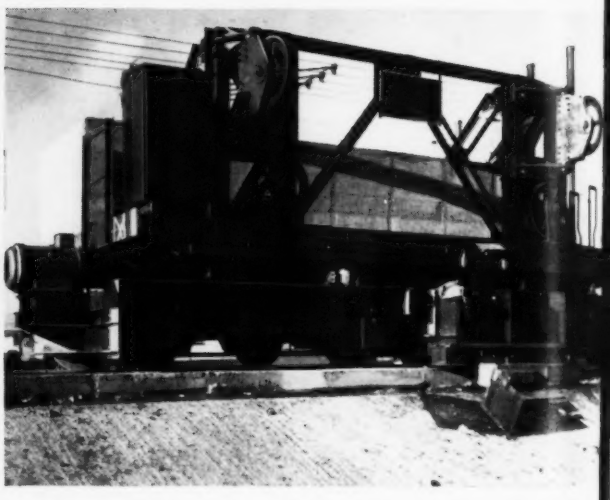

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Fig. 17. *Drag scraper control gear, within drag scraper control room*

Fig. 18. *View of stocking-out conveyor from drag scraper control room with stockpile beyond*

Figs. 19 & 20. *View of drag scraper and tail car from drag scraper control room*

Figs. 21 & 22. *Close-up views of the drag scraper tail cars*

constructed power stations. Comparing the best handling practice of pre-1939 stations with the best handling practice of present-day stations, indicates that the major developments are in the following fields: (*a*) the size of handling plant as a whole, (*b*) the size of individual handling equipments, (*c*) plant reliability, (*d*) in-built safety features, (*e*) in-built cleanliness, and (*f*) in-built servicing facilities.

The modern power station has a minimum number of boilers and generators, each boiler and generator forming a complete self-contained unit. Each unit is very much larger than in average stations of pre-1939 vintage. And, because of its greater output capacity, each requires a much greater hourly supply of coal than in pre-1939 days. Each of the modern stations requires a greater gross coal supply per hour. And, in comparison with pre-1939 days, each station, although handling far more coal per hour, operates with a considerably smaller number of duplicate conveyors, and, generally speaking, with less coaling staff per wagon discharged. Conveyors, elevators and ancillary handling equipments are very much larger, unit for unit, than in pre-1939 days.

Increased size of handling equipment is mainly a matter of scaling-up. What is of far more interest than mere increase in size, is the vastly improved quality of modern coal handling plants. The first part of this report described in general terms, some of the handling improvements at Goldington Power Station, particularly those concerning safety, dust control, and the ability to handle wet coal. In

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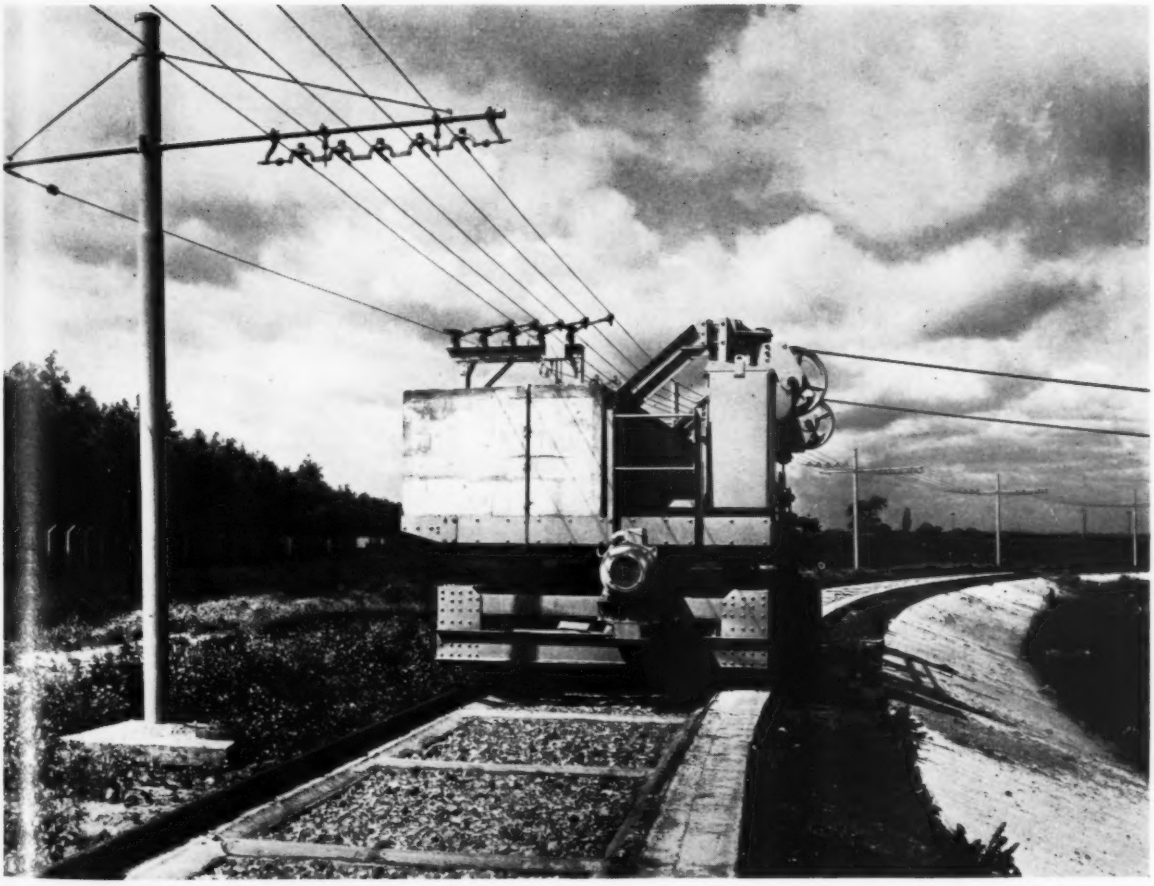

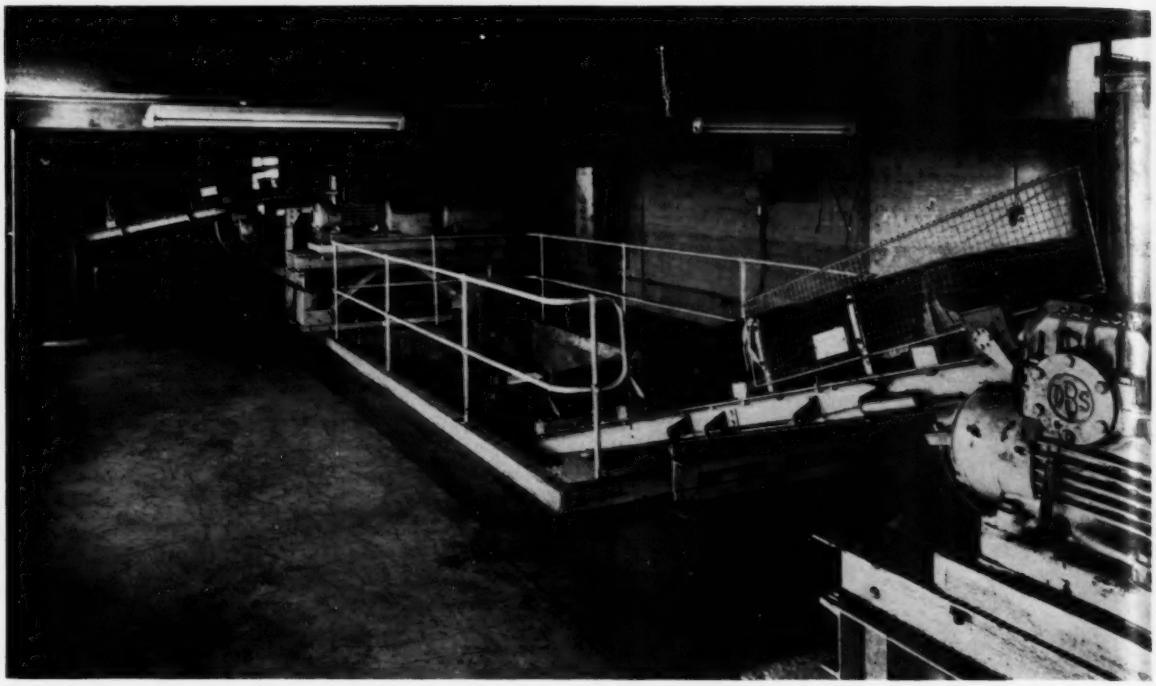

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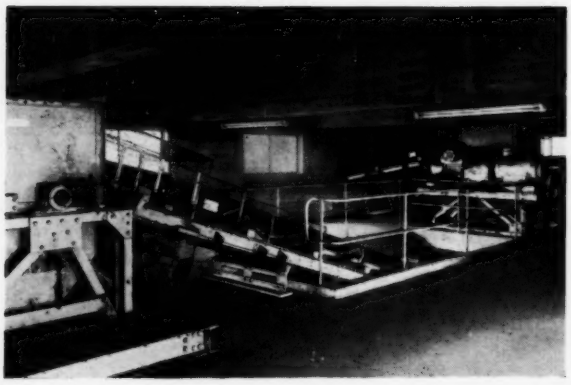


Fig. 23 (top) & 24. Views of heads of conveyors Nos. 7 and 8 within tippler and stocking-out conveyor tower. Note trip chains

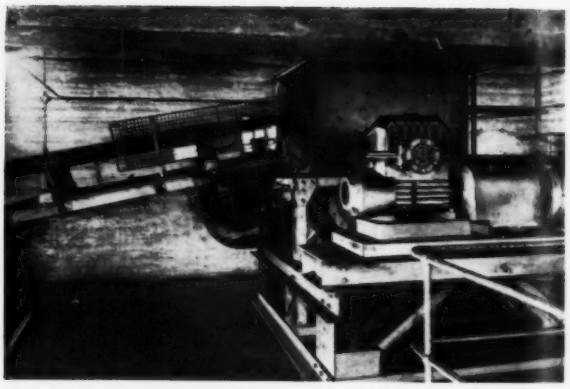


Fig. 25. Close-up view of head of conveyor No. 7, showing trip chain

what follows other aspects of design are described and some details are given of the construction of the coal-handling plant at Goldington.

General Layout of Goldington Coal-handling System

The coal-handling plant at Goldington Power Station was designed and supplied by International Combustion Products, Ltd. Its general layout is shown in diagrams, Figs. 3, 4 and 7, which were published in Part One of this report, in last month's issue of *Mechanical Handling*.

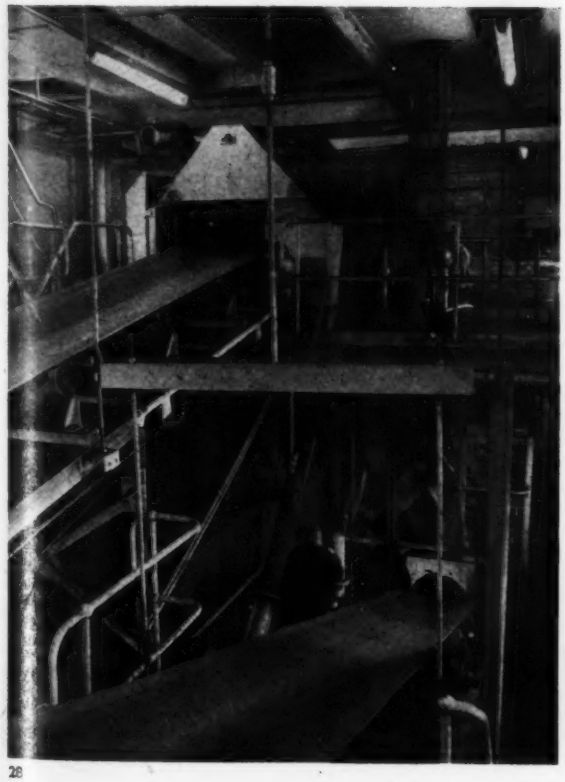
Coal trains from the Midland coalfields are diverted from the adjacent main railway line into the power station's own sidings via a specially constructed bridge, the locomotives being re-coupled on to the trains of empty wagons for return to the coalfields. The sidings contain six sets of through lines in parallel, together with a seventh spur line. These are arranged to feed four sets of lines to the coaling plant, two for full wagons, two of returning empties, as shown in Fig. 3. Other spur lines lead into the power station workshops and into either end of the power station boiler house and turbine room, enabling plant and equipment to be delivered directly to site. At present coal wagons, etc., are shunted to the coaling plant by means of an oil-burning steam locomotive but, no doubt, in due course, a diesel locomotive or electric locomotive can be expected to put in an appearance.

Wagon unloading is by means of two Strachan & Henshaw 'Rotaside' electrically operated side-discharge combined tipplers and weighers, discharging through grids into receiving hoppers located between the railway tracks. Each

26

Fig. 26. *View along conveyor No.* 7, *showing trip chain*

Figs. 27 *and* 28. *Interior views of conveyor junction house (conveyor transfer house) showing conveyors Nos.* 2 *and* 7 *and automatic weigh-bridge sections of these conveyors*



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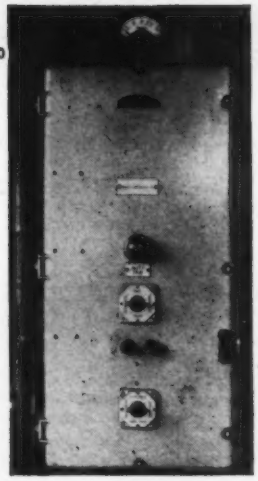

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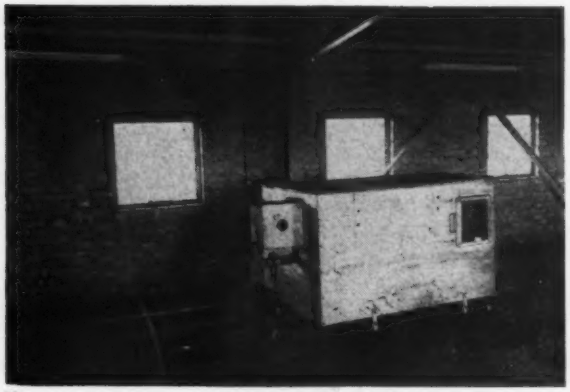
Fig. 29. *One of two automatic weighing machines, located in the weigh-house above the conveyors shown in Figs.* 27 *and* 28

Fig. 30. *Control panel for conveyor No.* 2. *Note auto-trip indicating lamp, test and sequence switch, and, at bottom of panel, combined four-position switch for conveyor isolation or normal running, with three positions for conveyor isolation*



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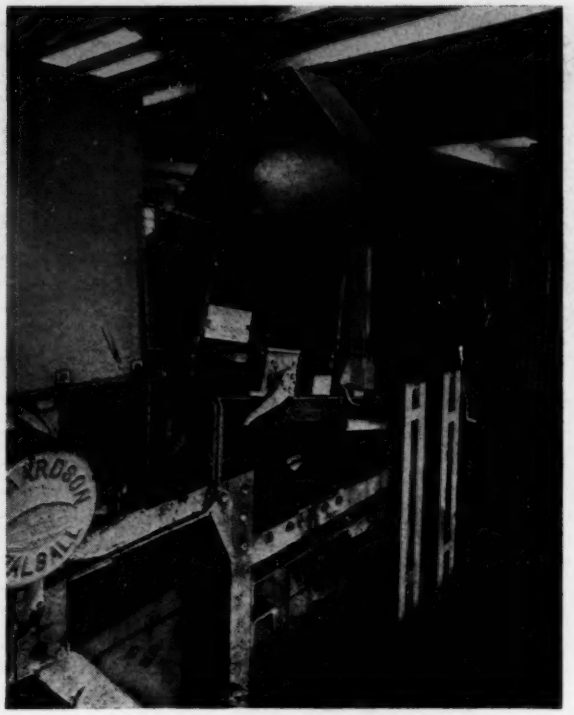

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Fig. 31. Coal sampling plant with guard covers removed. Note emergency pull-chain type cutout control

Fig. 32. Drive head of No. 2 conveyor during construction, immediately prior to completion of guarding system

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Fig. 33. Drive of No. 2 conveyor, showing Pollock coal sampler

Fig. 34. Delivery chute from tippler to No. 2 conveyor. Note sealing system to prevent exit of dust, with electro-magnetic vibrating feeder to rear

Fig. 35. Sampling coal

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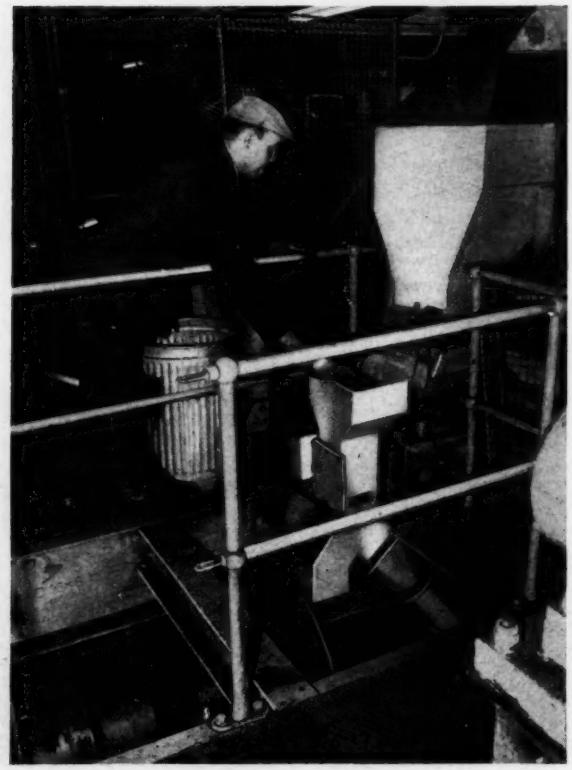

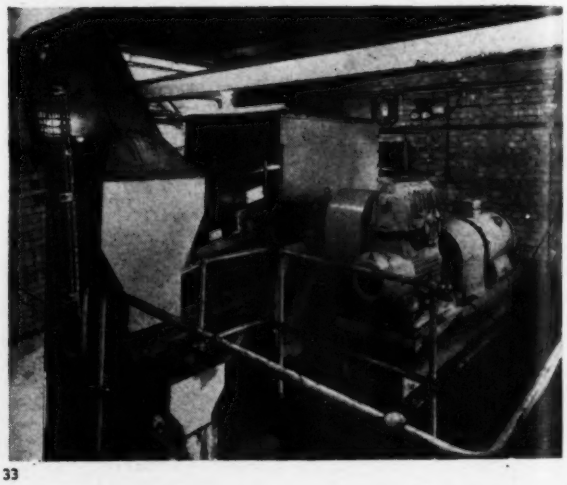

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tippler is of 250 tons per hour capacity and is automatically self-clamping, suitable for existing 10-, 12- and 20-ton coal wagons, as well as the new British Railways 24½-ton mineral wagons. Figs. 5, 6, 8 and 9 show general features of these tipplers. They are complete with interlocking and protective gear and powered by weatherproofed 40 b.h.p. 750 r.p.m. outdoor electric motors. The individual weighers have approved-type recording and totalizing heads. Tippler performances is as given in Table 1.

Table 1.—Performance of Strachan & Henshaw combined side discharge tipplers and weighers

Time required (average)	10-ton trucks	20-ton trucks	24½-ton trucks
To weigh full truck	22 sec	42 sec	50 sec
To elevate to tipping position	60 sec	60 sec	60 sec
To return to position of rest	60 sec	60 sec	60 sec
To weigh empty truck	20 sec	14 sec	14 sec
To carry out shunting	120 sec	120 sec	120 sec
Total Cycle Time	269 sec	296 sec	304 sec

Guaranteed limit of service error of automatic weighers
In accordance with Board of Trade regulations

The coal tippler receiving hoppers are of reinforced concrete, with steel bar sizing grids having open spaces not more than 3 in wide, design and construction being as shown in the diagrams, Figs. 13 and 14. The coal is discharged from the receiving hoppers on to one feeder belt conveyor, via Syntron electro-magnetic vibrating feeders. There are six vibrating feeders in all, three per tippler, each of 125 tons/hr output capacity, and instantly adjustable in output from 25 tons/hr per feeder, to 125 tons/hr. All feeder wearing parts are easily renewable.

The general conveyor belt layout is shown in Figs. 3, 4 and 7. No. 1 conveyor is used to bring coal from the outdoor stockpile into the boiler house bunkers. Reclaimed coal is discharged from No. 1 conveyor on to No. 2 conveyor, as shown in Figs. 7 and 14. The tippler hoppers also discharge on to No. 2 belt conveyor, incoming coal being normally from one source or the other at any one time. Both Nos. 1 and 2 belt convyors are 42 in wide, each are of 250 tons/hr capacity, normal running speeds being 195 ft/min for No. 1 conveyor, and 200 ft/min for No. 2 conveyor, this difference being to ensure that there is no possible tendency to build-up.

No. 2 belt conveyor is used in either of two alternative ways, (*a*) to deliver coal from the tippler hoppers and/or outdoor stockpile to the boiler house bunkers, or (*b*) to deliver coal from the tippler hoppers to the outdoor stockpiling system, via the drag scraper plant. As shown in Fig. 7 there is a two-position switch at the head of conveyor No. 2, enabling it to discharge either to (*a*) Nos. 3 and 4 conveyors, or (*b*) to No. 7 conveyor. Nos. 3 and 4 conveyors deliver the coal to the boiler house bunkers, being fed through a three-position switch which enables either conveyor only to be fed from No. 2 conveyor, or both conveyors to be fed at the same time. No. 7 conveyor takes the coal out to the stockpile via No. 8 conveyor, No. 9 radial conveyor, and a telescopic chute, shown in the illustrations, Figs. 6, 11, 12 and 15, and in some detail in the diagram, Fig. 13.

Fig. 36. General view along No. 3 and No. 4 conveyor tunnel

Nos. 3 and 4 belt conveyors are each of 125 tons/hr capacity, 30 in wide, and 212 ft/min normal travel speed. Belt conveyors Nos. 7, 8 and 9, are each of 250 tons/hr capacity, 36 in wide, and respectively 270 ft/min, 275 ft/min and 280 ft/min normal travel speeds, the gradual increase being, as before, to avoid any risk of build-up.

Nos. 3 and 4 belt conveyors incorporate magnetic head pulleys and suspended-type magnetic separators for removal of any tramp iron which might be present in the coal.* These conveyors are located in a tunnel beneath the roadway and railtracks between the coaling plant and the boiler house, and discharge on to a pair of gravity bucket conveyor-elevators, via rotary feeders. The gravity bucket conveyor-elevators, No. 1 and 2 machines, Fig. 39, elevate the coal to boiler house roof level. They are each of 125 tons/hr capacity and 50 ft/min travel speed, with very large buckets, each 35 × 31½ in in dimensions, and with a vertical lift of 120 ft. They are fitted with chains having nylon bushes and requiring no lubrication.

Nos. 1 and 2 gravity bucket conveyor-elevators discharge coal on to a pair of bunker feed conveyors, Nos. 5 and 6 belt conveyors. These are each of 125 tons/hr capacity, 30 in wide, and with normal travel speeds of 220 ft/min, which may be compared with 212 ft/min for belt conveyors Nos. 3 and 4. Delivery of coal to the bunkers is by means of 125 tons/hr travelling trippers, running at 30 ft/min and having double discharge chutes, these being used in the usual way to deliver coal to any section of the bunkers, or to distribute it evenly throughout the length of boiler house bunkers.

On the coaling plant side of the railway tracks there are two junction towers, as shown in Figs. 5, 8, 15 and 16. The taller of these towers is a combined tippler house, drag scraper junction tower and belt conveyor junction tower.

*Typical of attention to detail is the use of electric instruments to indicate whether the magnetic separators and pulleys are energized.

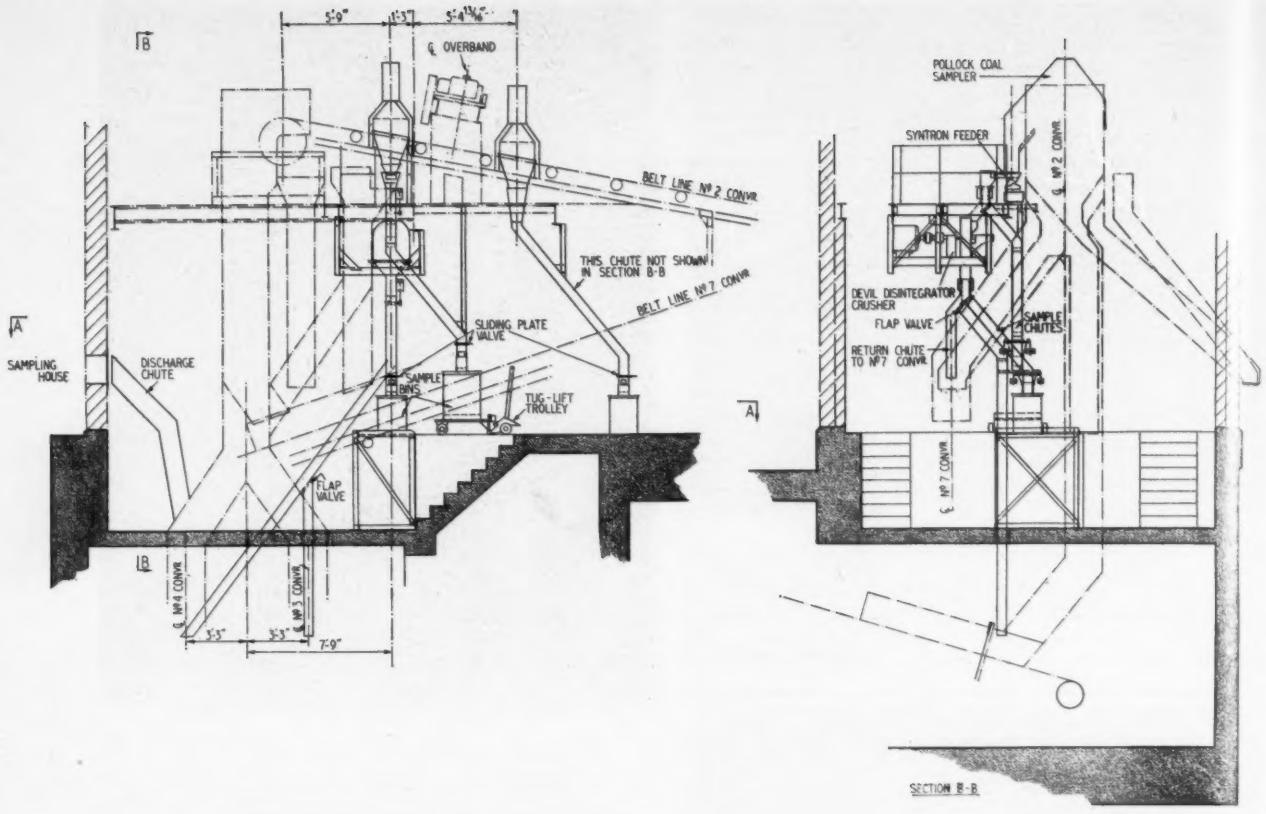
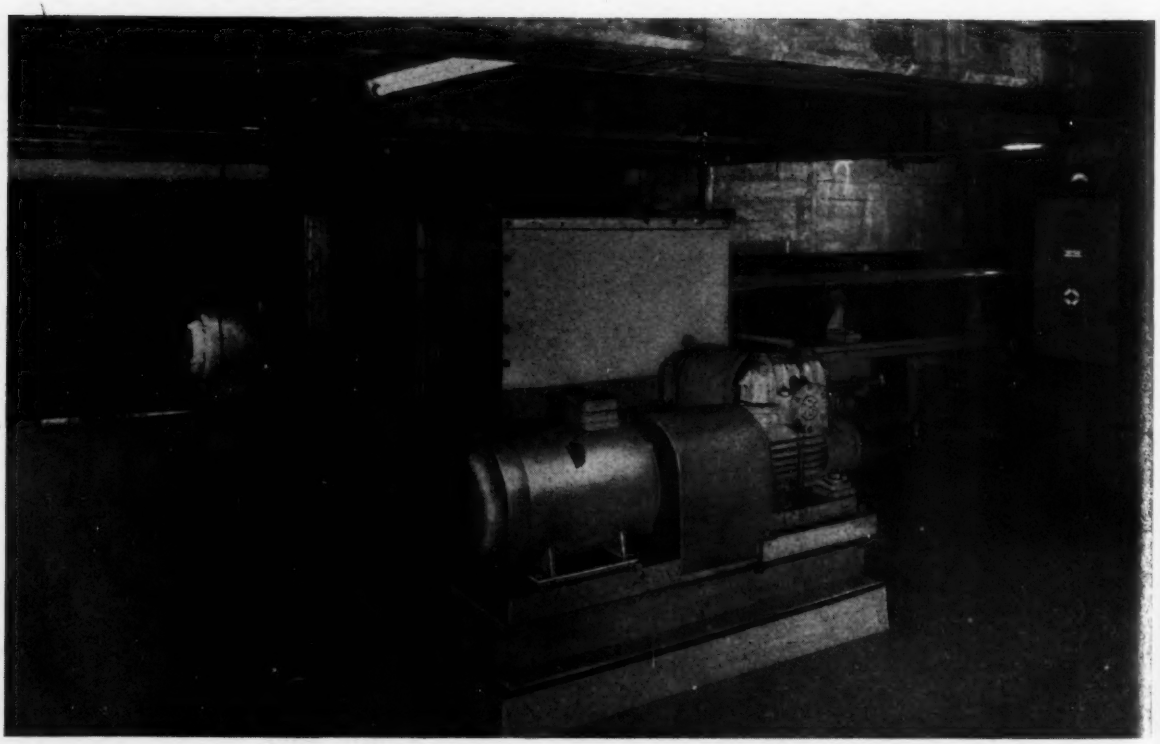


Fig. 37. Details of sampling plant

Fig. 38. Drive heads of Nos. 3 and 4 conveyors



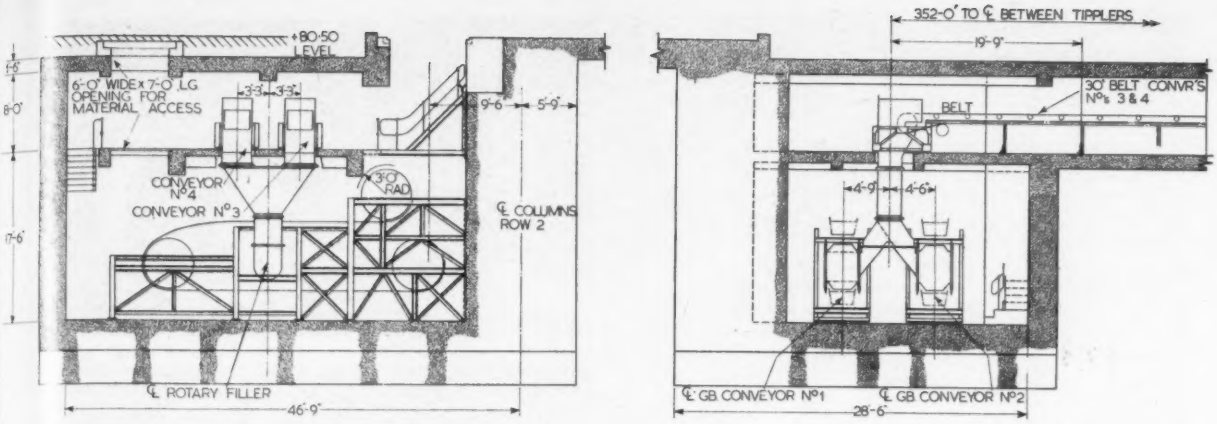


Fig. 39. Layout of gravity bucket conveyor pit

The conveyor gantry running downward from this tower to the smaller tower, as shown in Fig. 8, houses No. 7 belt conveyor, which travels upwards to the top of the taller tower. The conveyor gantry seen in Fig. 8, going from the smaller tower and penetrating ground level, houses No. 2 belt conveyor, which travels upwards from the base of the taller tower. Views of belt conveyors Nos. 2 and 7 are shown in Figs. 27 and 28. A view along No. 7 belt conveyor is shown in Fig. 26. The heads of conveyors Nos. 7 and 8 are shown in Figs. 23 and 24. A view along the conveyor tunnel, showing Nos. 3 and 4 belt conveyors, is given in Fig. 36. Nos. 1 and 2 gravity roller conveyor elevators are shown in Figs. 40 and 41.

Coal Stockpile Plant

A 'Beaumont' drag scraper system manufactured by International Combustion Products, Ltd., is used for outdoor storage and reclamation. The general design and construction of this plant is clearly shown in the diagrams, Figs. 3, 7, 13, 14, and the photographs, Figs. 6, 11, 12, 17, 18, 19, 20, 21 and 22. It has an average capacity of 65 tons/hr when hauling coal to or from the most distant point from the head post, about 550 ft. When hauling coal to or from a point 300 ft from the head post the capacity is 225 tons/hr. And, for a distance of 60 ft from the head post, the capacity is 450 tons/hr.

The drag scraper bucket has a normal capacity of 160 cu. ft, corresponding to 3·65 tons of coal. The speed of travel of the bucket over the coal storage area is 450 ft/min loaded, and 450 ft/min empty. The maximum pull in the drag scraper hauling rope is 13·1 tons. The coal storage area is able to accommodate 83,000 tons.

The drag scraper winch is motor driven, the motor running continuously in one direction, forward and reverse motions being obtained through gearing and clutches, the system being fully interlocked for safety. The scraper bucket is of mild steel, stiffened, with renewable lip and wear-resisting shoes. The tail block car is electrically driven and remote-controlled from the control panel, Fig. 17. As shown in Figs. 21 and 22, it is in fact a type of electric locomotive, running on circular tracks and arranged to act as a variable position drag scraper anchor point. A signal arm, readily seen from the control cabin in the junction tower, clearly indicates whether the rail clamps are in the on or off position.

A comprehensive electrical interlocking and protective system is incorporated into the design. This controls drag scraper operation and safeguards the plant and the operators against maloperation from any cause. The starting equipment for the drag scraper winch main motor is located in a winch house adjacent to the main junction tower, and it may be stopped both from the winch house and from the control cabin. The forward and reverse clutches are operated electrically from the control cabin and there are special provisions to ensure that there is no danger of confusion of mind of the operator regarding the correct position in which to place the switch in order to obtain any required motion of the drag scraper bucket after changing from storing to reclaiming operations and vice versa.

The operation of the tail car is also controlled from the same point in the control cabin. This is arranged to provide the following sequences of operation: (i) release of rail clamps on the tail block car, (ii) starting up of the travelling motor of the tail block car, (iii) shutting down of the travelling motor, (iv) securing rail clamps when the tail block car has arrived at its new position, as required for drag scraping duties. This control sequence is obtained by means of electrically interlocked starting switches which operate the appropriate driving motors, together with the interlocking of control switches for the drag scraper plant winch and the tail car, the main point being to ensure that drag scraper operation is not possible unless the tail car is clamped. Weatherproof iron-clad triple pole switches are used to isolate the electric power supply to the overhead conductors of the tail block car. As a point of interest it might be worth noting that the tail block car weighs 31 tons and that about 48 tons of concrete ballast have been added to provide the necessary anchorage stability.

The drag scraper reclaiming hopper, shown in Figs. 3, 4, 13 and 14, is of reinforced concrete, with a steel bar sizing grid having open spaces not more than 3 in wide. It has two outlet gates which deliver reclaimed coal on to No. 1 belt conveyor, as shown in Fig. 14. These gates can be hand-operated and can be completely closed so as to efficiently isolate the flow of coal. They are of the water collecting type, arranged so that any water finding its way into the hoppers is collected and led out via the nearest drainage point. The coal is scraped into the reclaiming hopper, during reclamation, and removed from the hopper with the aid of two vibrating electro-magnetic feeders, similar to those used to discharge the tippler hoppers.

'Beaumont' drag scrapers are well-established and well known amongst mechanical handling engineers and for this reason it has been assumed that the basic principles of this equipment do not require listing in this report. However, it would not be amiss to point out that one of the major

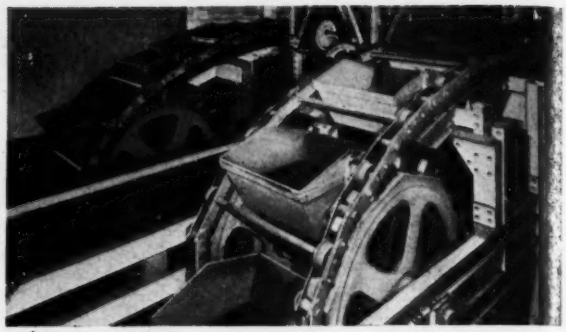
advantages of this system is its ability to pile the coal in horizontal layers, the fine coal being packed into the interstices of the larger coal, there being little or no tendency to separate the sizes. The pile is packed so closely that air finds it difficult to enter.

One final practical point may also be noted. The radial conveyor, No. 9 conveyor, Figs. 11 and 12, is long enough to enable an initial pile of coal to be formed, this being far enough out from the head post of the drag scraper to allow ample room for the proper filling of the drap scraper bucket when stocking out coal. It is, of course, slewed mechanically, and provided with a variable discharge height chute to enable the operator to compensate for variations in coal pile level. A gangway along its length enables operators to carry out conveyor lubrication and see to maintenance tasks.

Other Items of Interest

Westminster conveyor belt-type automatic coal weighers are incorporated into the lines of belt conveyors Nos. 2 and 7. One weigher can be seen in the photograph, Fig. 29. This is located above the roof seen in Fig. 28, which is within the smaller of the two junction towers. The conveyor belt section corresponding to one of the weighers can be seen in Fig. 28. Each of the weighers has a capacity of 155 tons/hr. The capacity of the weighers used in conjunction with the tipplers is 310 tons/hr each. The weighers have indicating and continuous recording mechanisms, and are guaranteed to have a limit of error not greater than plus or minus ½ per cent in ordinary service.

Two Pollock automatic coal samplers are also fitted, Fig. 37, both on No. 2 belt conveyor, adjustable for sampling rates of 55, 35 or 20 increments per hour, weight of increment being adjustable between 1 lb and 5 lb in steps of 1 lb. The discharge ends of the samplers are in the form of ducts with close-fitting lids, arranged to prevent entry or exit of moisture to or from the collecting bins. There are six sampling bins, each holding 3 cwt of coal, provided with lifting eyes and well-fitting lids, and arranged for rapid and simple exchange.



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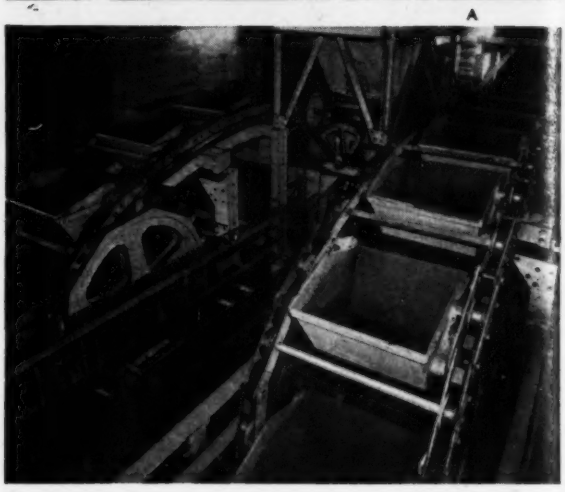

B

Fig. 40a. Loading point and boot of gravity bucket conveyors, prior to completion of guarding system

Fig. 40b. Loading point and boot of gravity bucket conveyors, after completion of guarding system

Fig. 41. Driving head of gravity bucket conveyors

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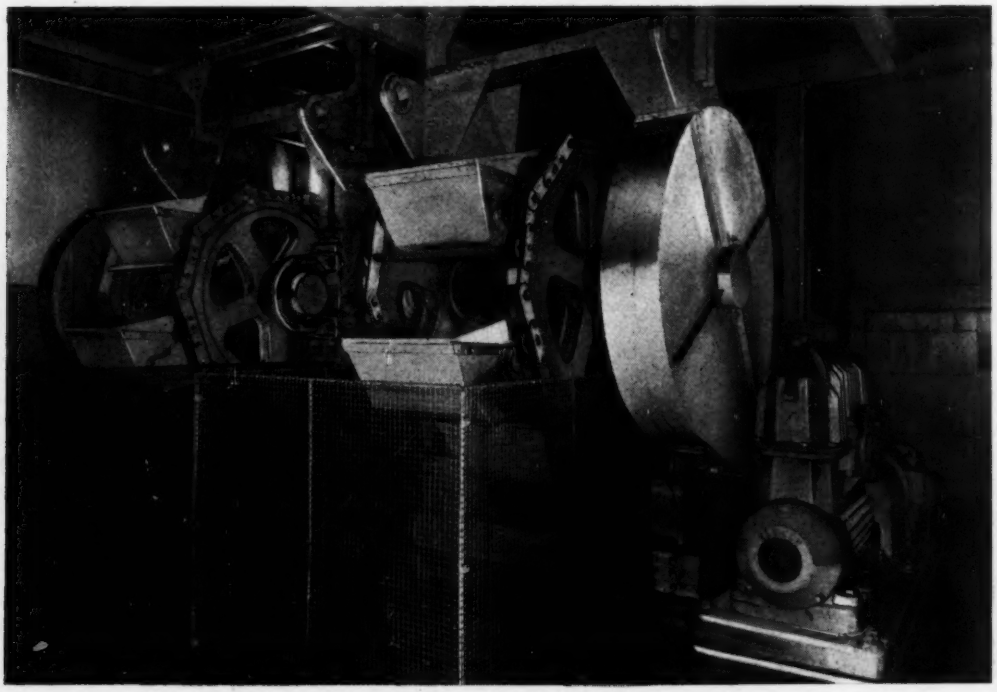


HANOVER FAIR

Fig. 1. View of the vast assembly of cranes and earth-moving machines in the Freigelände West taken from the top of the Hermes-Turm. Looking South-East the photograph conveys the busy atmosphere of this section of the Freigelände

HANOVER FAIR, still called officially the German Industries Fair, though permanently sited on the 158-acre Messegelände, and truly international in character, emphasizes the universal nature of the mechanical handling function. By the arrangement of exhibits in industrial groups housed in individual buildings, each designed for its purpose and strongly charcteristic of its own trade, the pervasiveness of this industry that serves all industries becomes strikingly apparent.

In most of the 27 groups of industries represented at the fair and located in 20 separate buildings and two large areas of open ground, mechanical handling equipment played its part, but this brief review can cover only the hoists and conveyors displayed as a group in a section of Hall No. 4 and the cranes and earth-moving equipment and contractors' plant in the large open space allocated to building engineering in the Freigelände West.

Fig. 2. Mobile and tower cranes South East corner of Freigelände West

Since last year's fair there has in these sections been little new development, but in competitive classes of equipment—cranes, hoists, conveyors—manufacturers have made a determined drive to reduce the costs of production and operation. One German firm, for example, in the latest version of their gantry crane, offer a cheaper, though heavier, structure of standard rolled steel sections in place of the tubular members employed in previous models. They are also making the crane mechanisms available separately, for export to overseas markets such as South America, thus saving the purchaser the transport charges on the gantry. Full instructions and working drawings for the entire structure enable him to specify the standard structural sections he needs and erect them himself.

To take another example, both space and cost have been saved by modifications made to overhead travelling cranes, and the structural details of these have been simplified as much as possible.

Of the well-established trend toward simplicity of control there was plenty of evidence. In most types of equipment the means of control have been simplified down to electric push-buttons and finger-light hydraulic levers, and all the functions of the system brought together in a single panel or cabin or, for the large cranes, at the end of a wandering lead. One of the manufacturers had even introduced a fork lift truck with push-button control.

For British users and manufacturers, one of the most immediate inferences to be drawn from the show was the extensive use made of mechanical handling equipment in the building industries in Germany and other countries outside the United Kingdom. In the section of the Freigelände West devoted to such equipment at least 16 different companies were showing conveyors designed and manu-

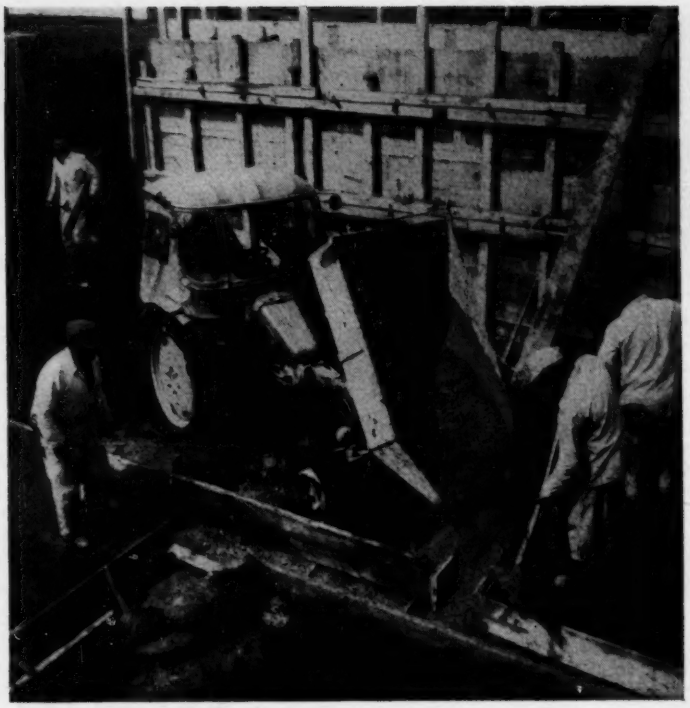


Fig. 3. Fendt tractor fitted with front-mounted tipping skip

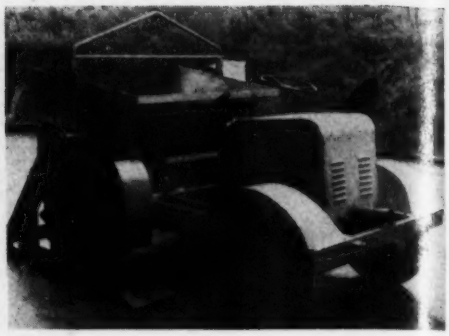


Fig. 5. C. H. Johnson Model 2/65 Dumper with "Tri-Skip"

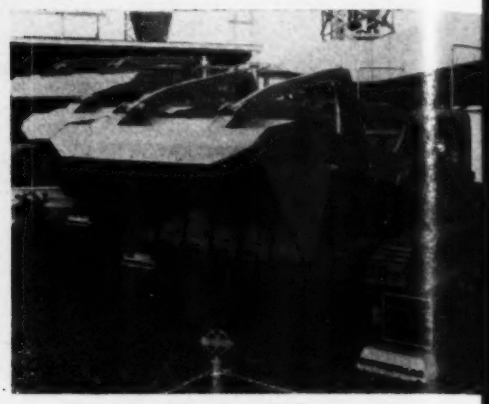


Fig. 4. The Caterpillar 933 Series F Traxcavator

factured for use on building sites; seven companies were noticed with hand scrapers, 11 with hoists, 10 with derricks, and 12 with cranes, and in addition to these there were the firms showing individual machines for use by builders among exhibits classified under other industrial groups.

Illustrations show examples of equipment presenting new or modified design features. Of these, two of the most interesting new developments were an overhead conveyor system from Switzerland with independent self-actuating carriers, and continuous weighing and blending systems, employing both load cells and beam balances, in which a high level of efficiency has been achieved in the measurement and control of the rate of flow.

British manufacturers of cranes and earth-moving machines were strongly represented in the large open section. In this section there was also a display of excavators, cranes, and bulldozers by Menck & Hambrock, G.m.b.H., Hamburg, and Leo Gottwald, Dusseldorf, group of Eimco loaders and graders and on the stand of Klockner & Co., Duisburg, bucket excavators, loaders and dumpers were permantly engaged in demolishing and making good their site. Beyond them were large Flamrick screens from Recklinghausen, and dumpers, silos, and concrete plant on the stands of Siegfried Potratz, Frankfurt, Waimer of Esslingen, Pfister-Waagen, Augsburg, and C. Blumhardt, Wuppertal, also Fuchs universal excavators fitted with various types of grabbing bucket (K. G. Fuchs, Ditzingen). J. C. Bamford (Excavators), Ltd., of Rochester, were showing their universal excavators. In the neighbouring block were Robel conveyors, in extendible and transportable sections, which are manufactured in Munich and handled in this country by David Roberts & Co. (Engineers), Ltd., Birmingham.

Grouped in the centre were the latest models of the hydraulic loaders and earthmovers manufactured by Chaseside Engineering Co., Ltd., Hertford, and an impressive display of bituminous roadmaking plant by Theodor Ohl, K. G., of Limburg. There was also a group of tower cranes by H. Liebherr, Biberach, who also showed loaders and a mobile crane of interesting design.

The centre section was devoted mainly to civil engineering plant dominated by a Mannesmann-Trauzl drilling rig and mobile LKW cranes manufactured by Coles Krane, G.m.b.H., Duisburg, the German associate of Steels Engineering Products, Ltd., Sunderland. A universal excavator and power shovel by Karl Mengele & Sohne, Gunzburg, diesel trucks, tractors and earth-moving machines by Hermann Lanz, Aulendorf, and a versatile self-loading multi-unit sectional transporter with containers by Stolberger Stolberg were shown.

Screens and batching and mixing plant by Huther & Co., Bechtheim, and by the Swedish firm, Pedershaab, Bronderslev, who showed an entirely automatic system for handling, proportioning and mixing concrete, and Metallbau K.G., Vhingen, who showed building construction and weighbatching plant. On the same block Josef Gressbgch & Sohne, Eisenbach, showed a variety of equipment that could be used on small building sites—chain and wire-rope hoists, gantries and hand-operated cranes. On the stands of K. G. Werne, and Alloys Eppenfeld, Gravenbrück, were mobile hoists, roof hoists and elevators.

Around the masts of the large Schwing tower cranes in the centre of the picture at the start of this report, one with horizontal jib-travelling trolley and the other with luffing jib, were other products of Friedrich Wilh. Swing G.m.b.H., Wanne-Eichel—pumps, pneumatic conveyors for handling concrete, scrapers, building hoists, derricks, concrete and

mortar mixers and soil stabilization equipment. On the adjacent stand Metallwerk Friedrichshafen G.m.b.H. showed Caterpillar graders, loaders, scrapers, scraper loaders, road levellers and universal excavator crane. In the foreground were hydraulic and magnetic equipment amongst crushing and screening pumps and pumps on the stand of Wedag, Westfalie, Dinnendahl Gröppel, A. G. Bochum. Occupying the whole Island front and main roadway is the International Harvester Co., G.m.b.H., of Neuss. Most of their exhibits which included graders, loaders and soil stabilization equipment can be seen in the photograph.

A fast travel truck-mounted model was in the forefront of the display of Gurns K. and L. Mobile Cranes manufactured by K. & L. Steel Founders, Ltd., Stevenage and exhibited by their German agents Mobilkranuertrieb I. Rieger, Düsseldorf. To the right was the J. Weitz tower crane with 26 m. (85 ft) horizontal jib and a tall tower crane in the background was on the stand of F. Potain & Cie., La Clayette, France.

Originating as a purely agricultural implement the Fendt tractor has recently gone into the building field. It can be fitted with a front-mounted tipping skip as shown or with a loader or with a tipping body. The hydraulic system is extended to the rear where standard three-point linkage enables any instruments to be fitted that comply with the international code. It is powered by a 2-cylinder air-cooled diesel engine developing 19 b.h.p., with a fuel consumption of 0·3 gal/hr. There is a six speed gearbox with high and low ratios giving six forward speeds with a maximum of 20 km/hr (12·4 m.p.h.) forward and 10·5 km/hr (6·5 m.p.h.) in reverse. Supplemented by a low range of three speeds forward and one reverse with a speed of 0·3 to 0·7 km/h (0·2 to 0·4 m.p.h.) in low bottom. The tipping skip shown has a truck capacity of 0·50 cu. m. (17·66 cu. ft.) and a load-carrying capacity of 1,050 kg (2,315 lb). Overall dimensions of the vehicle are 3,160 mm (124·4 in) length by 1515 mm (59·59 in) width. Truck is adjustable from 49·2 to 59 in. (X. Fendt & Co., Marktoberdorf.)

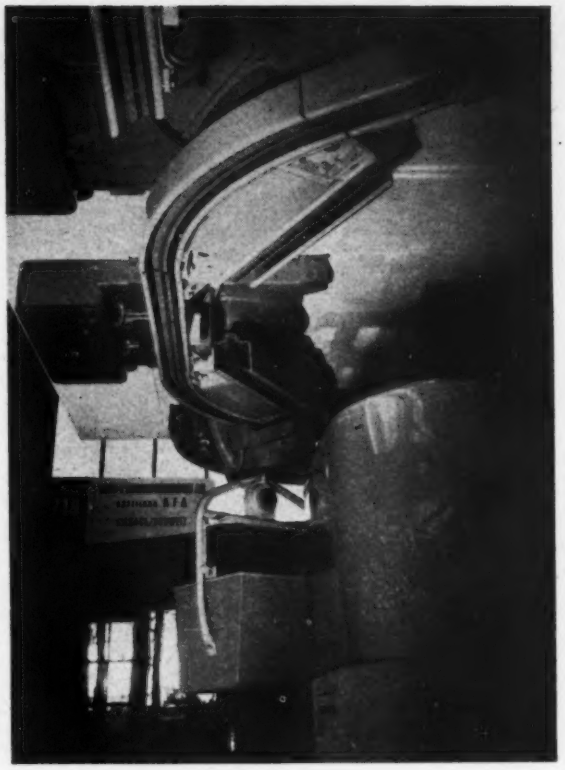


Fig. 7. Eisen 'AFA Rail' fully automatic overhead conveyor

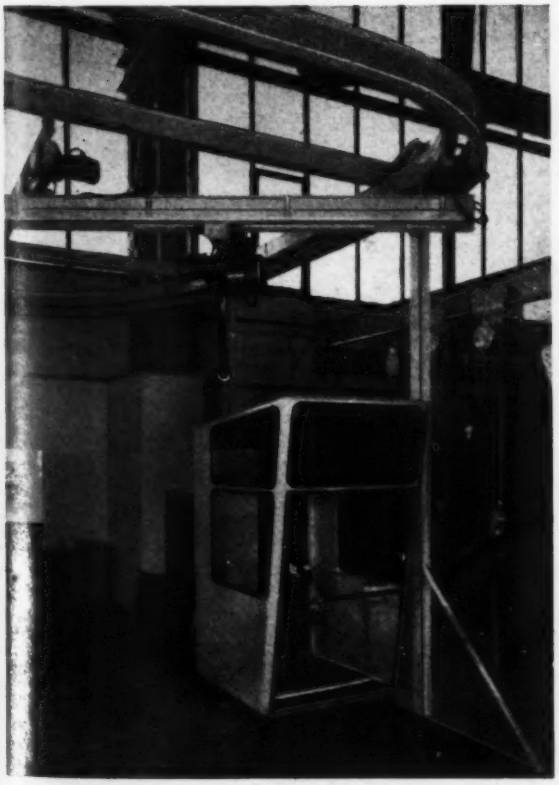


Fig. 6. Pivoting beam for the Wiesner 10-ton travelling hoist

Two new Kats were on the stand of Metallwerk Friedrichshafen G.m.b.H., Friedrichshafen, the Caterpillar agents: 933 Series F. 'Traxcavator' which will supersede the 1933 Series E model. At 0·85 cu. m (1·22 cu. yd.), the bucket capacity of this track-mounted excavator-loader is increased by 12½ per cent. The fitting of the new motor and other improved features has resulted in a 22 per cent improvement on the average of four series of test performances. The results of these test performances have just come in but details of the specification are not yet available.

Fitted with a 150 b.h.p. 6-cylinder turbo-charged engine, the new No. 14 motor grader weighs 13,300 kg (23,400 lb) and carries a 3,657 mm × 685 mm × 22 mm (144 × 27 × 7 in) blade. Alternative 4,267-mm (168-in) blade is available. Also shown were other traxcavators and motors, rippers, tractors and scraper and dump-trailer, including the British-built D8 and the D7, neither of which had been seen at Hanover before.

A new development in 'Kuli' cranes is the building of the structure from standard rolled steel sections for interchangeability and ease of erection. The system was introduced and illustrated on the stand of **Helmut Kempkes, Remscheid.**

Known to readers of *Mechanical Handling*, but new to visitors to Hanover Fair were the Johnson 'One-Twenty' and and 'Twin/Sixty-Five' dumpers and 'Trip-Skip' automatic

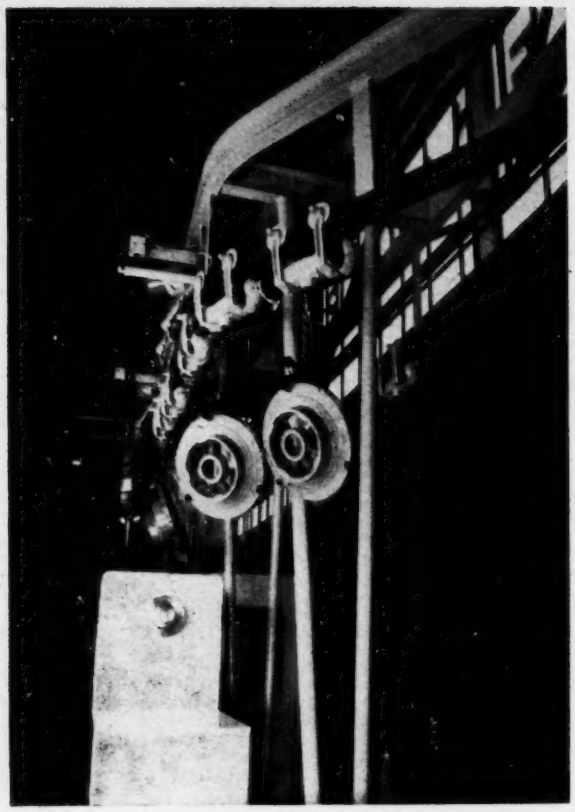


Fig. 8. Demonstrating the application of the Elektus electric hoist

skip removal and loading device. An articulated chassis with pivoted front end capable of a 2-ft rocking movement is the principal feature of the 'One-Twenty', which is fitted with a Lister 6·3 b.h.p. air-cooled diesel engine and Ford clutch and gearbox and has a struck capacity of 18 cu. ft. The 'Twin/Sixty-Five' dumper of 35 cu. ft. struck capacity, as shown in Fig. 5, was fitted with a crane skip and operating in conjunction with the 'Trip-Skip' equipment. It is powered by a Petter diesel engine continuously rated at 12 b.h.p. **(C. H. Johnson (Machinery), Ltd., Stockport).**

A working demonstration was given of this new and interesting fully automatic overhead conveyor system, known as the 'AFA Rail'. It is simple to operate, cheap to run, and entirely flexible. Materials can be carried on as many as 30 interconnected routes, and the layout was arranged to show off the capabilities of the conveyor by including the greatest possible number of twists and turns and turntable switches that could be accommodated in the confines of the stand.

Fig. 7 illustrates the electromechanical system by which the self-actuating carriers follow programmes initiated by electronic relays. Each carrier collects its own current from the overhead busbar, and stops, starts and operates its own turntable switches, on receiving the appropriate signals from micro-switches placed along the route. Any number of programmes can be stored in transistorized circuits, and the sequence is followed automatically under the over-riding control of a straightforward push-button panel.

The good design of the parts is typified by the simplicity and strength of the rail section, which has been photographed in the upside-down position for greater clarity. **(Eisen & Stahlwarenfabrik A.-G., Sissach, Switzerland).**

Headroom requirements are reduced by the simplified form of the modified overhead structure supporting the Wiesner 10-ton travelling hoist, and the minimum radius at bends is down to approximately 4 ft. In a working demonstration the motions were controlled from a cabin equipped with right-hand and left-hand rotary switches, each providing eight positions. One of the switches can be seen in Fig. 6, which shows the pivoting beam at one of the corners of the circuit. **(Dr. Wiesner & Co., Minden).**

The demonstration mock-up (Fig. 8) illustrates an interesting real-life application of 'Elektus' electric hoists which are used in conjunction with carriers moving by gravity on overhead runways between the operating stations. **(R. Stahl, Stuttgart).**

In a two-tier conveyor the top and bottom surfaces of the steel band are used for carrying the load. Based on a similar principle to that of the Sandvic conveyor installed in a Lancashire corset factory (*Mechanical Handling*, August, 1957), it has been developed by **Schön & Cie, G.m.b.H., Pirmasens,** with the radio manufacturing industry in mind. It will handle units of up to 8 in dia, and support a loading of 25 kg/m (55 lb/yd).

Schön first produced steel-band conveyors four years ago in which two parallel bands moved in opposite directions in the same horizontal plane, but the two-tier arrangement is a new departure.

Fig. 9. In this demonstration of the Schenck strain-gauge weighing system for cranes and hoists, duplicate readings were compared and a high degree of accuracy was maintained. The weigh-hooks are now available in a standard series with overall heights ranging from 540 mm (19·685 in) for loads up to ½ ton to 2,500 mm (98·425 in) for 50-ton loads. In a prototype demonstrated inside the

Fig. 9. Demonstration of the Schenck strain-gauge weighing system for cranes and hoists

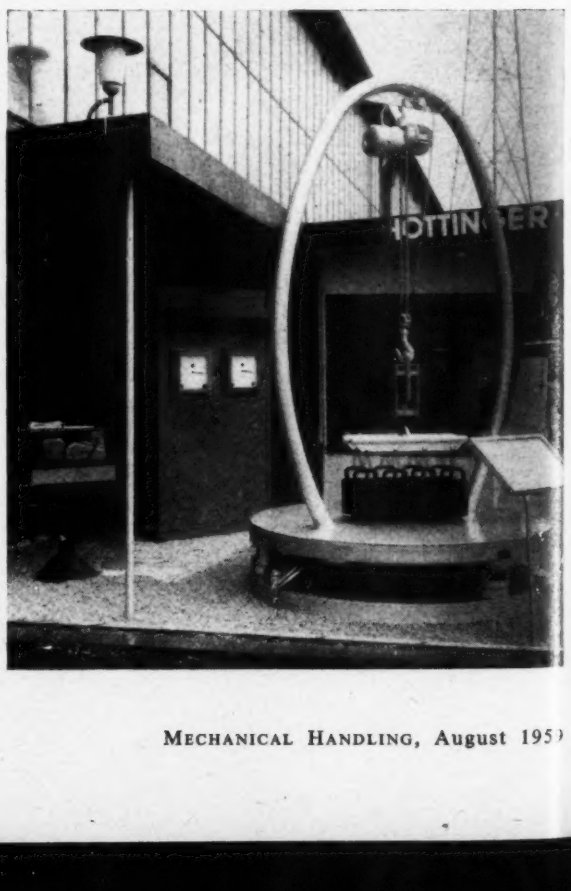


Fig. 10. *Hydraulically operated man-and-materials elevator on stand of Tegu, Darmstadt*

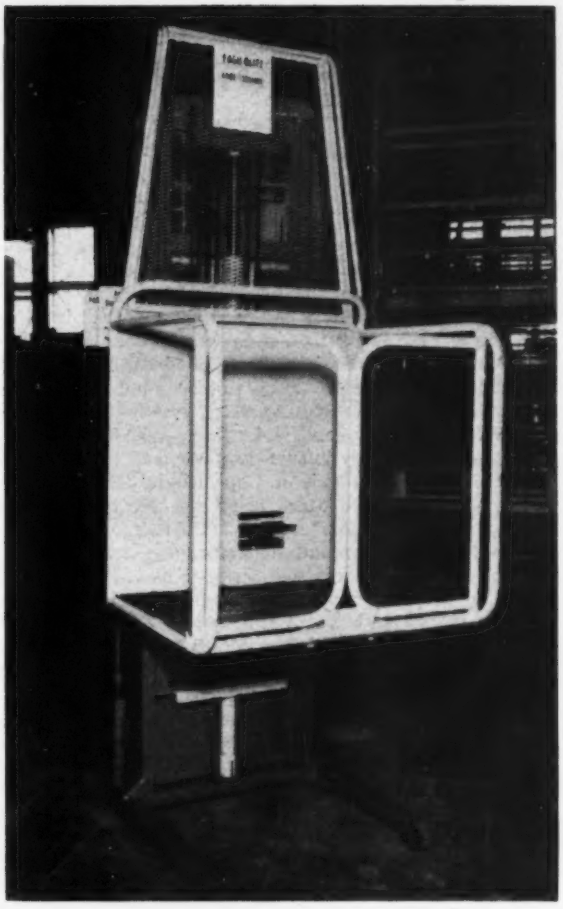


Fig. 11. *Loads of up to* 1,000 *kg* (2,205 *lb*) *can be raised on the swivelling boom of this battery-electric straddle truck* (*C. & W. Sichelschmidt, Wilmerstein*)

building, load cells were used for the first time by this company in one of their continuous belt-weighers. This was the 'One-roll' EB8, fitted with an 800-mm (31·496-in) belt, which performs the four additional functions of indicating the weighments, counting, recording, and transmitting signals for the actuation of ancillary equipment. (**Carl Schenck, G.m.b.H., Darmstadt**).

A prototype DMF2, continuous feeding and weighing unit is the 1,000th weighing machine produced by **Carl Schenck.** It will be available in various sizes providing throughput rates of 5-50 kg (11-110 lb) an hour. The initial maximum capacity can be reduced steplessly in a 10:1 ratio to obtain any predetermined throughput by electronic control of the belt speed. Weight control is effectively maintained at a high level of accuracy by the comparator system that has proved successful in the large machines, variations in the density of the material being compensated automatically by the belt feeder.

Four years ago bottles were carried through a Linn furnace of the type represented in this model at a speed that gave a cold-cold cycle time of 3½-4 hr. The current heating baking-cooling plant is handling medium bottle glass at a 2½-hr rate. **August Linn, of Hersbruck,** were the first to introduce forced-air circulation, which extended the life of the belt and attribute much of the recent increase in speed to improvements in the quality of the belts themselves. Woven wire belts, they say, are no longer liable to the stretching that progressively reduced the capacity of the furnace, and by selecting the right belt for the job it is now reasonable to anticipate a useful working life of five years.

In a model of a tower pickling plant, the strip is passed vertically through acid sprayed by single-stage or multi-stage pumps and collected in containers for recirculation. In addition to reducing the floor space requirement by 75 per cent, the method is said to produce excellent results at high operational speeds. Existing horizontal plants can be converted to the system and the mechanical handling equipment redeployed without alteration. (**Ruthner, Vienna**).

SEVENTH
MECHANICAL HANDLING EXHIBITION - 1960

The Seventh Mechanical Handling Exhibition (organized by this journal) will be held next year at Earls Court, London, from Tuesday, May 3rd, until, Friday, May 13th, 1960.

WANDERHAUFEN MALTING SYSTEM

STOPES IN his book *Malt and Malting*, published in 1885, states that the Wanderhaufen System of Malting, which is pneumatic malting of a semi-continuous nature, was first invented in Austria in 1882 by Völkner, and installed by Johann Schilcher in the maltings of his Brewery near Graz in South-West Austria. There is, however, some evidence that this system was already known elsewhere, and that it was in fact invented by Jacobsen of Copenhagen. Basically this system involves steeped barley being cast into one end of a long box or 'street' with a perforated false floor, which is subdivided beneath the floor into sixteen or more sections. During the next twelve hours this barley is moved one section along the box by a chain and bucket turner. The next steep is then cast into the box immediately behind the first batch. There is no division between the pieces. The turner then moves both pieces forward and the next steep is moved in behind. After a pre-determined number of days germination, the malt is unloaded by the turner into conveying machinery which conveys it to kiln. Alternatively, the last section of the box may be designed as a kiln and finished malt is then discharged by the turner. Initially, this system found little favour as manual movement of the malt, which lies perhaps 3 ft deep, was necessary. Interest increased with the design and development of a mechanical turner in 1947 by the German Engineer, Ostertag. The first was installed at the Reininghaus Brewery of Graz, which had bought up Schilcher's Brewery, and whose director, Johann Peter *v.* Reininghaus, was principally responsible for the development of the system on a fully commercial scale. There are now plants in Germany, Japan, Austria, Czechoslovakia, Spain, Italy and Ireland.

The plant in Ireland has been installed by Minch, Norton & Co. Ltd., formerly known as M. Minch & Son, which was established in 1847 by the grandfather of the present Chairman. It is the only pneumatic maltings, either drum or box, in this country. The reason being perhaps that the Irish climate which has an average temp. 53 deg F; temp. range 18 deg F; average R.H. 37 per cent; range of R.H. 11 per cent is, with the exception of the Faroe Islands, possibly the most favourable in the world for floor maltings without air conditioning. Unfortunately, therefore, little technical information with particular reference to this country was available on which to base the design of the plant. For this reason all operations have been carefully instrumented. The barley is weighed automatically both into steep and off kiln. The water for (a) steeps, (b) air conditioning, (c) washing, is separately metered, as is the electrical supply for (a) the barley steep house, (b) the germinating room, (c) the control room. This will enable accurate figures to be available for cost control of the malting process and for a prediction of the load demand of such additions to the plant as may be necessary. The 'street' is housed in what was the barley loft of a maltings built in 1904. This maltings on two floors 190 ft x 50 ft, twin kilns, and an overhead storage loft, was designed for an output of 100 quarters every four days. Modernization of the kilns, involving the installation of oil firing equipment, kiln turners, pressure fans and recirculation, has increased the capacity to 125 quarters every three days. To economize in barley handling charges two storage blocks with built-in cooling and fumigating systems were constructed, and this made the loft floor available. To accommodate the turner the roof was removed, the walls raised to give a minimum height of 14 ft, and a new roof of pre-stressed concrete beams fitted. A new kiln of novel, perhaps unique design was built to deal with the output of the floor maltings, which will remain in production.

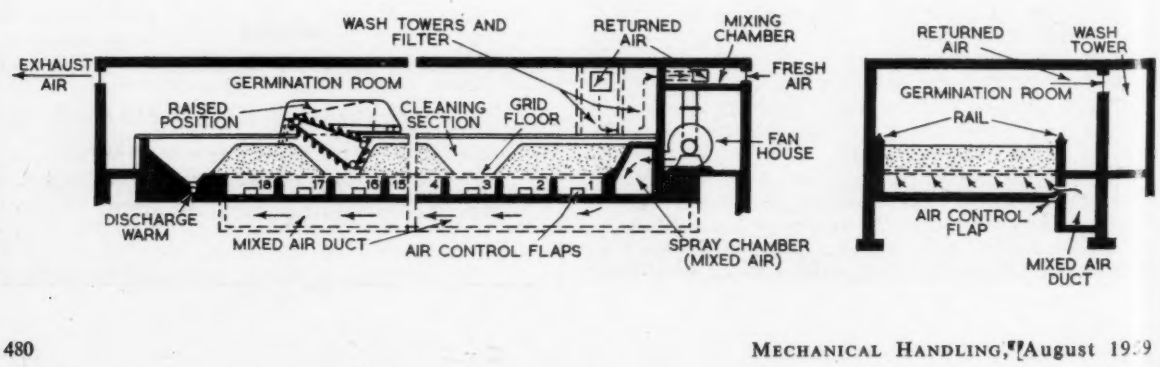
The following is a description of the layout and operation of the plant:—

LAYOUT

Steep House

The steep house can accommodate three pairs of steel cylindrical hopper-bottomed steeping tanks, fitted with external aeration coils, which are automatically operated by a programme controller. The steeping time can, therefore, be as much as 72 hours if necessary. The barley can be pumped from steep to steep and thence to the box. To date four steeps have been installed, one being used for experimental purposes and control floor malting experiments. The output of the plant varies from 10 tons with eight days' germination to 15 tons with five days' germination. A 10-ton batch occupies two sections, a 12·5-ton batch 3 sections, and a 15-ton batch 4 sections.

Fig. 1. *Diagrammatic representation of basic design*



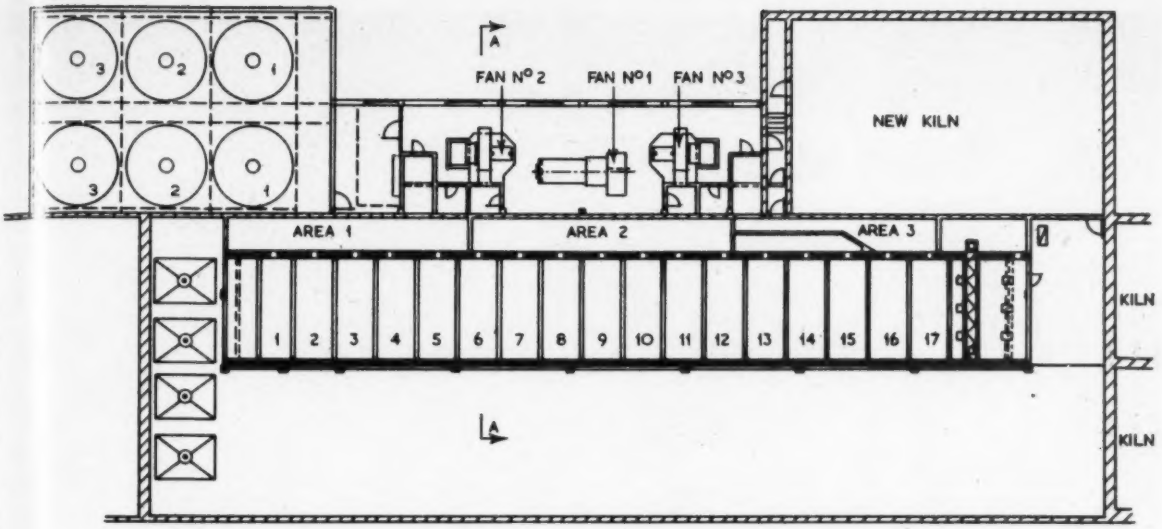


Fig. 2. Ground plan of steep house; control room with air conditioning and ventilating system, and germinating room

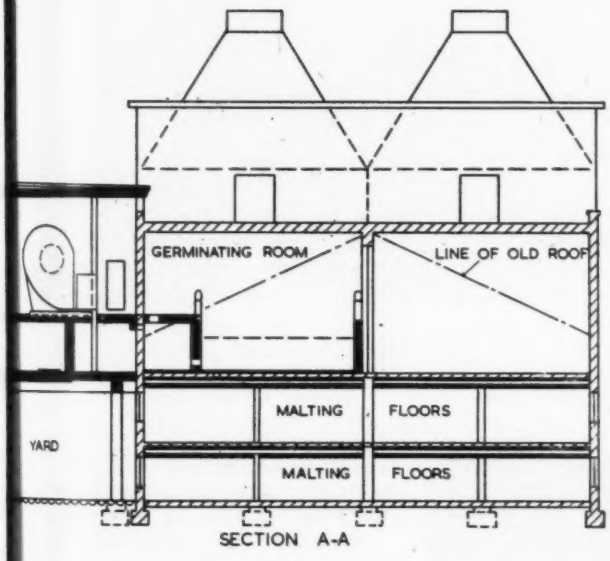


Fig. 3. Section A—A of above

Control Room

The control room, the 'cellar' of which is a 10,000 gal water storage tank, is built on stilts along the northern aspect of the malt-house. In this way the ventilation of the floor maltings is not adversely affected. It contains the electrical control gear, the barley drying fan furnace unit, and the ventilating fans with their associated air conditioning equipment.

Germinating Room

The germinating room occupies most of one half of the top floor, which is divided down its long axis by a wall. The roof and walls are of vitreous tiles. The box itself is 160 ft x 17 ft. There is, therefore, room for a second box at a later date to be served from the existing steep house and by the existing turner.

The Kilns

The kilns presently operate on a 48-hour cycle. The malt is distributed on them with a mobile loader and spreader and is unloaded into self-emptying hoppers beneath.

OPERATION

Barley Drying

Hot air from the oil furnace is drawn into the fan (1) and then blown into the centre area of the main distribution duct and also bled off into fan (2). Fan (2) supplies the first five sections of the box with any desired mixture of this air and the warm moist air which has already passed through the grain bed. The first two sections are, therefore, 'sweating' sections. Sections 6 to 15 are supplied with warm atmospheric air only. Fan (3) supplies Sections 16 to 19 and is a cooling fan only. If required, however, the box can be supplied exclusively by fan (1). A batch of barley is loaded and unloaded approximately every two hours and the total drying time for each batch is, therefore, about sixteen hours.

Malting

Air is sucked into fans (2) and (3), and is either (a) atmospheric air, (b) used air returning from the germinating room, (c) a mixture of both. These fans force the air spray chambers into the main distributing ducts from whence it passes to each of the sub-sections. Fan (2) can supply either area 1, or areas 1 and 2 of the main duct, while fan (3) can supply either area 3 or areas 2 and 3 of the main duct. There is quantitative control of air to all sub-divisions of the box, and qualitative control to any of the three areas of the box corresponding to the 3 arbitrary sub-divisions of the main duct. Air being re-used is passed through washing towers before re-entering the fans.

The main advantages claimed for the system are:—

(1) One box and turner, which can serve more than one street, produce one batch daily, and the same volume and sequence of work occurs each day which is desirable. Daily batch production with Saladin or Drum methods requires 6-8 boxes or drums.
(2) Gentle turning action with no rootlet damage.
(3) Rapid mechanized green malt unloading without any

Fig. 4. Germinating room

Fig. 5. Close up of Wanderhaufen Turner

additional equipment.

(4) Washing down procedure greatly reduced. This is due to two reasons. The first is that the steep water drains away from two or at most four sections only, and it does so every day giving mould little time to develop. The second is that by having an extra section continuously empty, cleaning of same can be carried out whenever convenient within a twelve-hour period, and each section of the box can be cleaned in sequence every eight days or less.

(5) Allows barley drying in a way which combines the virtues of the continuous dryer and the kiln.

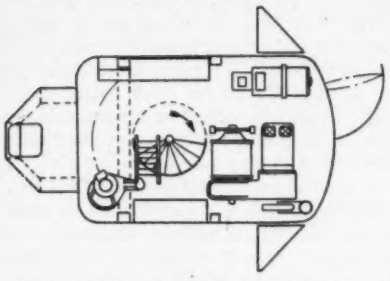


Fig. 2. Plan view showing layout of machinery house

Dockside Crane of New Design

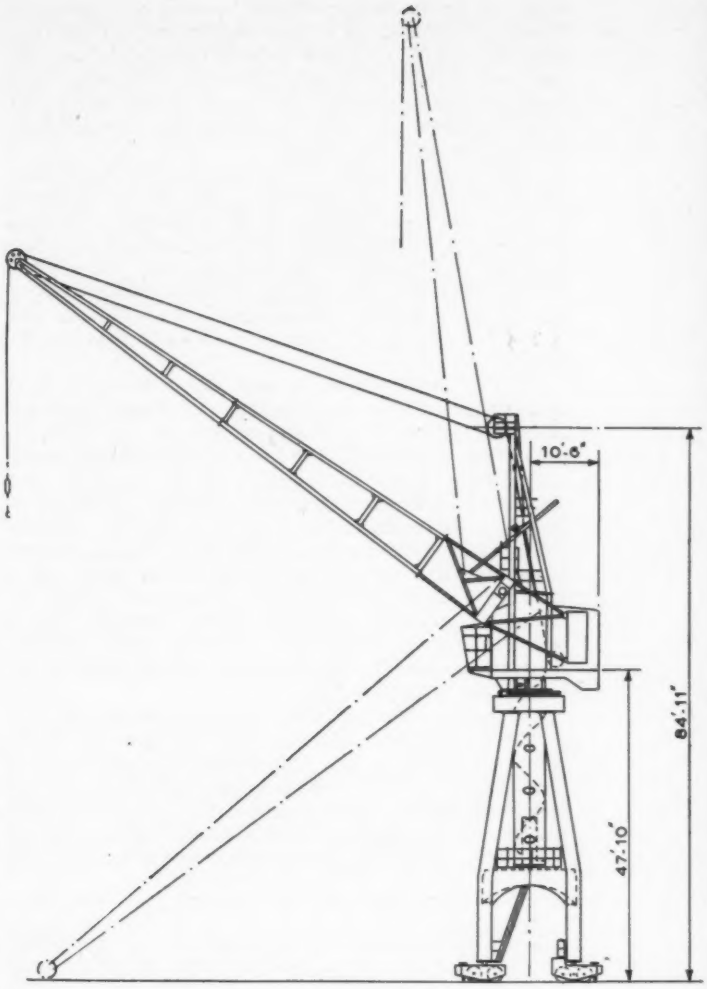


Fig. 1. Overall dimensions of the new crane

AFTER SEVERAL YEARS of design and development an entirely new type of dockside crane has been introduced by Stothart & Pitt, Ltd. Of particularly clean and pleasing appearance it can lift 5 tons at 80 ft or 6 tons at 70 ft radius and can be adapted for occasional grabbing duties. Total weight is 82 tons plus 12 tons of concrete at site, although ballast is not required for 15 ft gauge crane track or over.

Among the many advantages claimed for this new crane over old types are: easier and more flexible control; reduction of atmospheric corrosion and area to be painted; reduction of greasing to once per year; lower centre of gravity; lower wind resistance giving increased safety and less wind effect on luffing and slewing; increased operating speed; easier access and more comfortable working conditions for the driver; shorter minimum lifting radius; shorter tail radius and less space occupied on the quay; access in all directions provided between the bogies; substantial reduction in total weight; lower power consumption; simplification of electrical equipment and reduction of complicated control year; total elimination of main current electrical resistances except for the slew gear; simplification of site assembly.

The crane is of welded construction using the minimum number of members bolted together at site. Secondary and breaking-up members have been eliminated where possible by increasing the strength of the main members, arranging these in the most effective way and by adopting the most modern construction methods. Members are generally tubular so as to obtain the maximum weight/strength and weight/stiffness ratios. The area of this crane which needs painting is about half that of the usual type.

A long pintle tube attached to the underside of the superstructure is fitted, at the upper end, with three adjustable rollers which rotate inside a segmental roller path bolted to the truck top. The outside of the ring has spur teeth for engagement with the slewing pinion. The lower end of the pintle tube is supported by an oil immersed roller thrust and journal bearing.

The jib is straight, balanced in all positions and has only one pulley spindle at the head. It is supported by means of a cross axle integral with the jib which turns in split trunnion bearings bolted to the superstructure. The balance weights are triangular in order to obtain the maximum moment with the minimum weight and tail radius. Toplis level luffing is used but the rope angles are arranged to eliminate the need for a back pulley at the superstructure apex.

The jib consists of three sections bolted together, each being a tubular welded fabrication employing the minimum number of members. It has been designed so that all four main members are subject to the same maximum load and stress.

Luffing is by means of a single centrally placed hydraulic ram of original design which ensures that, although the driver controls the variable luffing speed, there is smooth acceleration and deceleration of the jib in all positions whatever the driver should do.

A specially developed, simplified, Ward-Leonard set drives the hoist winch through double helical and spur gearing. It has an exciter, energized by the current in the armature loop circuit, which simultaneously controls the winch motor field and the generator field. This provides the following main advantages. The hoisting and lowering speeds are variable and controlled by the driver; light loads can be hoisted at three times the speed of the maximum load, and intermediate loads at corresponding speeds, without the use of discriminating relays; a similar characteristic is available when lowering, i.e. as the load is increased the maximum speed is

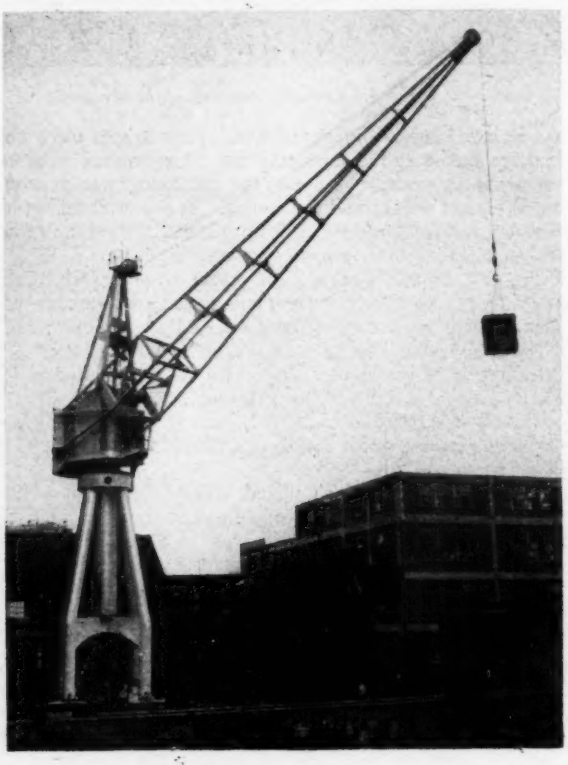
decreased; automatically controlled lowering by regenerative braking is employed on all lowering notches. An electromagnetic brake is used only to hold the load in the 'off' position and for an emergency; control is obtained entirely on light current contactors. No contactors are used in the main D.C. circuit; whatever the load no heavy current surges are thrown on the supply line.

A D.C. solenoid controlled brake is fitted to the outside of the totally enclosed hoist gear box to which the electric motor is flange mounted. The hoist barrel is mounted on a dead shaft which is located by a ball and socket joint at the gearbox end and by a bracket at the opposite end. The drive is transmitted to it by means of an involute splined coupling capable of tolerating mis-alignment. This obviates the necessity of accurate alignment of the hoist gearbox and the bracket.

The slew motor drives the slew pinion through a fluid coupling and a train of spur gearing. This protects the motor and gear against overload and shock loads and ensures a smooth and even drive. The brake is under the permanent control of a thrustor but its action can be intensified by a pedal-operated hydraulic gear with a limiting device to prevent excessive inertia loading. This gives the driver a sensitive but limited control for arresting the slewing action and at the same time provides an automatic brake which would stop and hold the revolving part of the crane without the driver's intervention. The slew pinion engages with a segmental spur ring bolted to the top of the truck. The ring is integral with the slewing roller path to ensure correct tooth engagement in all positions.

The four two-wheeled bogies are fitted with swivelling as well as rocking gear to minimize cross-racking and enable the crane to negotiate curves. Two of the bogies are fitted with travel gear in which the motor drives through a fluid coupling and worm and spur gear to both wheels. This ensures a smooth and even drive and gives protection against overload and shock. Automatic solenoid controlled brakes are fitted to the powered bogies and a hand-operated safety locking device is fitted to the other bogies. Each bogie has an equalizing jack with a protected screw.

Fig. 3. *Tubular construction is used extensively*



All machinery, except for the travel gear and the luffing ram, is situated inside the machinery house. It is in self-contained units with flange mounted electric motors. Gears are totally enclosed, oil bath lubricated. The units are designed so that alternative drive means may be provided with little alteration to design or construction; thus a rectifier and D.C. motor may be fitted as an alternative to a Ward-Leonard set, and so may the various A.C. drive systems either with or without change speed gears for the hoist.

The machinery house is constructed of translucent resin-bonded glass fibre which, without windows, gives soft uniform lighting within. A wall crane is provided inside the house capable of lifting any of the machinery units. Jack-knife doors at the back of the house enable any of the units inside to be swung out on the crane. All steel fittings of the house which are exposed to the weather are galvanized.

The driver's cabin is constructed of resin-bonded glass fibre and galvanized steel. 'Rubber glazed' safety glass is used throughout and a window is provided in the floor and another in the roof. An adjustable seat is provided for the driver who operates the crane by means of joystick controls.

Access to the driver's cabin is by a step ladder to the pintle platform level, through a sliding door into the pintle tube, up a spiral staircase inside the tube to the machinery house and thence through a door into the driver's cabin. Rung ladders give access through a trap door in the roof of the machinery house to the luffing ram and the apex pulley. No jib ladder is provided as access is obtained by lowering the jib head to the ground.

Ball or roller bearings, fitted with seals, and packed with non-coagulating grease are used for all high and medium speed bearings. All other bearings, except for lever gear within the house, are lined with graphite impregnated Ferobestos. These bearings only require grease as a means of preventing the shaft from rusting.

The crane conforms generally to British Standard 2452 : 1954, and in some respects the requirements of this specification are exceeded. If rail centres are measured to 20 ft or more the number of legs can be reduced to three and the number of rail wheels to 6.

General Specification

Maximum load	5 or 6 tons
Radius—5 ton	20 ft min 80 ft max
6 ton	18 ft min 70 ft max
Jib centres	90 ft (5 ton) 78 ft (6 ton)
Tail and clearance radius	10 ft 6 in
Rail centres	13 ft 6 in
Height of cab floor	47 ft 10 in
Height of jib foot axle	59 ft 9 in
Height of apex pulley	84 ft 11 in.
Number of rail wheels	8
Diameter of rail wheels	2 ft 3 in
Maximum wheel load (based on 13 ft 6 in rail centres)	22 tons
Height of C.G. above rails	about 32 ft
Hoist gear motor	1. 60 h.p. Ward-Leonard 2. 75 h.p. Ward-Leonard
Hoist speed maximum 60 h.p. motor	1. 0 to 5 tons, 425 to 144 ft/min
Hoist speed maximum 75 h.p. motor	2. 0 to 5 tons, 425 to 180 ft/min

Slew motor	A.C. 15 h.p. S.R. 970 r.p.m.
Slew speed	1¼ r.p.m.
Slew gear	Fluid coupling and spur
Luff gear motor	A.C. 5½ h.p. Sq. C. 1440 r.p.m.
Luff gear speed	0/160 ft/min
Luff gear	Hydraulic ram
Travel gear motor	A.C. 2 at 6 h.p. Sq. C. 1450 r.p.m.
Travel speed	50 ft/min
Travel gear	Fluid coupling, worm and spur

Sub-Contractors for the Stothert & Pitt new design dockside crane DD. 2 are as follows:- hydraulic equipment, Keelavite Hydraulics Ltd.; hoist motor and motor generator set for hoist, Mawdsley's Ltd.; electrical control equipment, Allen West & Co.; motors for luff, slew, travel, Lancashire Dynamo & Crypto Ltd.; brakes for hoist, slew and travel, Elliston, Evans & Jackson Ltd.; machinery house and driver's cabin, Longwell Green Coach Works Ltd.; fluid couplings for slew and travel, Fluidrive Engineering Co. Ltd.; ball and roller bearings, Skefko Ball Bearing Co. Ltd.; taper roller bearings, British Timken Limited; ropes, British Ropes Ltd.; Ferobestos bearings, J. W. Roberts Ltd.; spheroidal graphite iron castings, John Williams & Sons (Cardiff) Ltd.

Gas-operated Fork Lift Trucks

THE OPERATION of industrial and agricultural vehicles by liquefied petroleum gas can be achieved either by the carburetter conversion of existing petroleum or diesel systems or by the installation of new L.P. gas-operated equipments. At a recent demonstration arranged by the Industrial Division of the Calor Gas (Distributing) Co. Ltd. the use of the type 156 bulk dispenser tank in conjunction with the Mark 12 40 lb fork lift truck cylinder was shown. The Hyster butane operated fork lift truck and the Lipton Carburetter Company's kits for converting petrol or diesel engines to L.P. gas-operated were also demonstrated.

The main advantages claimed for L.P. Gas (Butane/Propane) operation of fork lift trucks over petrol and diesel operated are:—Butane combustion leaves no carbon deposits so that no carburetter or sparking plug cleaning, or engine de-carbonizing is necessary; engine oil lasts 8 to 10 times longer, saving in fuel bills can be as much as 35 per cent, in the case of engines converted from petrol operation; carbon monoxide in exhaust gases is considerably reduced, and the exhaust gases are also virtually free from eye and throat irritants.

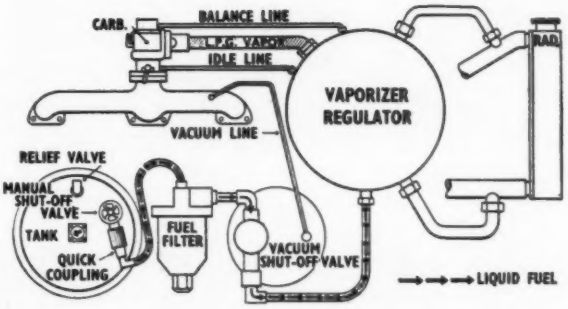
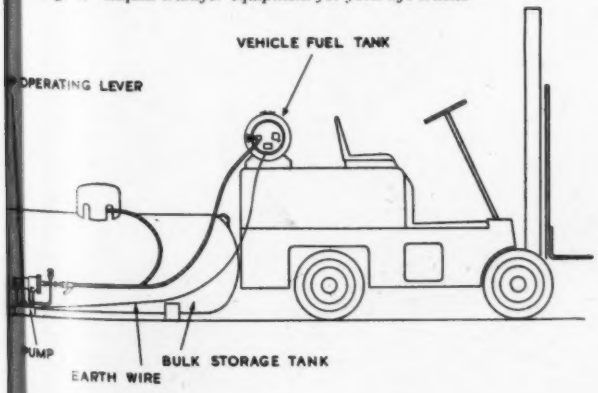


Fig. 2. Diagram of the Lipton conversion equipment

Fig. 1. Liquid transfer equipment for fork lift trucks



With the Calor Gas bulk supply system for fork lift trucks a storage tank is installed at the user's premises and kept filled by the Company's bulk delivery vehicles. Each fork lift truck is fitted with the new Mark 12 cylinder, complete with the necessary valves and connections.

The storage tank is fitted with a small hand pump and hose connection by means of which the cylinder is filled, the whole operation of transferring the L.P. gas from storage tank to cylinder takes about two minutes. If preferred the Company's normal system of exchanging full for empty cylinders can be arranged.

The Hyster fork lift truck demonstrated was of 4,000-lb capacity and supplied by Fred Myers Ltd. L.P. gas equipment is also available for the 3,000 and 5,000-lb capacity Hyster models.

Equipment for the Hyster consists of a fuel tank; a manual shut-off valve located in the fuel withdrawal line, with an excess flow check valve which seals automatically in case of a broken fuel line; a safety release valve set to release vapour if tank pressure rises above safe operating pressure and a

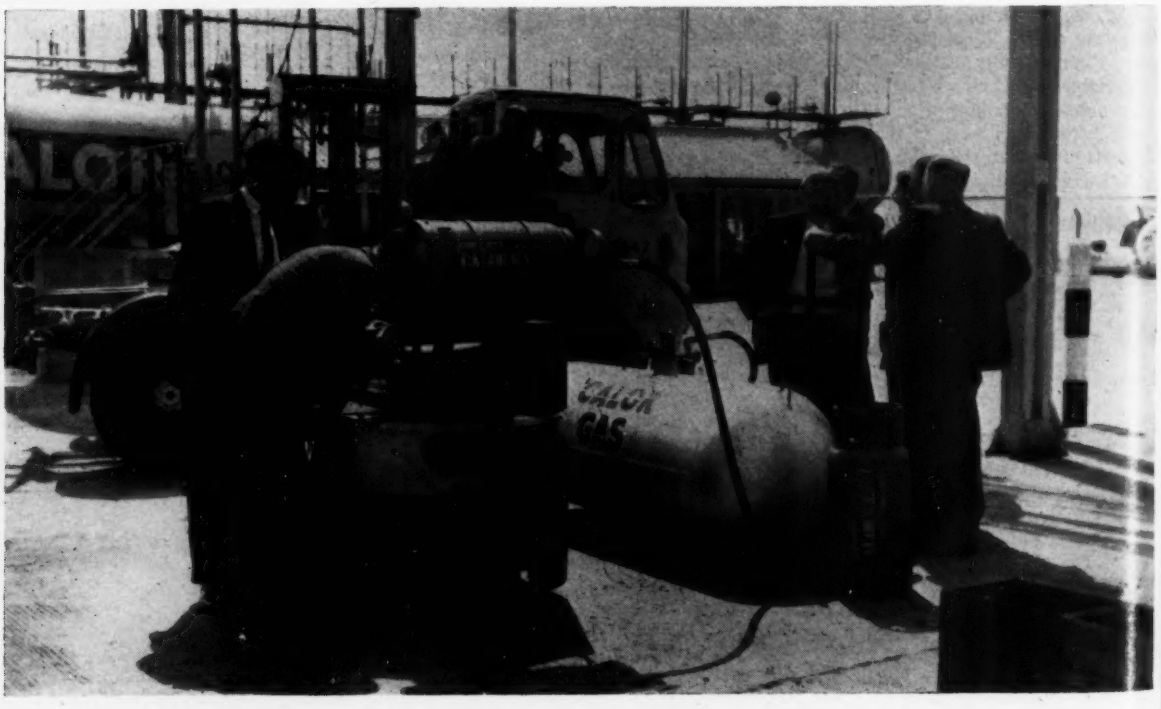
Fig. 3. Bulk supply storage tank with pump and 40 lb cylinder

Fig. 4. The Hyster 4,000 lb capacity fork lift truck fitted with L.P.-Gas equipment

liquid level gauge indicating level in per cent of total tank capacity. There is also a fuel filter; a solenoid shut-off valve which automatically shuts off the fuel when ignition switch is turned off; a hydrostatic pressure relief valve which protects the fuel tank against excessive pressure build-ups; a vaporizer regulator which is a combination heat exchanger and pressure regulator; a vacuum switch connected at the intake manifold in series between the solenoid valve and the spark coil which shuts off the flow of fuel at the solenoid valve when there is no vacuum in the intake manifold. Should the engine stall or stop running for any reaosn, the vacuum switch will energize the solenoid and thereby shut off the flow of fuel. Finally there is a carburetter of special design.

The L.P. gas conversion kit made by Lipton L.P. Carburetter Co. Ltd., is available for converting either petrol or diesel engines to L.P. gas operation. The kit is supplied complete with instructions for installing and consists of four main items with accessories: 1, automatic engine safety shut-off valve; 2, L.P. gas liquid filter; 3, vaporizer-regulator unit; 4, the carburetter.

With the Lipton L.P. Gas Carburetter system, directly the engine is turned over by the starter, inlet manifold vacuum acting upon safety vacuum shut-off valve opens the valve, allowing L.P. gas under pressure to pass from the tank through to the filter and on to the vaporizer-regulator where, in the first stage, fuel pressure is reduced to about 4 lb; during this process the fuel expands to almost a gaseous state. In the second stage of vaporization heat is applied by means of the engine water circulating system. This thoroughly vaporizes the fuel. In the third and last stage the vaporized L.P. gas is again reduced in pressure to slightly below atmospheric before it is drawn by engine vacuum to the Lipton carburetter, where fuel and air are accurately proportioned and mixed within the venturi to meet every engine demand.



RAPID ADVANCES IN THE MECHANIZATION OF BUILDING PROCESSES

New methods encourage new equipment trends

By T. W. Highgate

Fig. 2. Tunny hydraulic crane, lorry-mounted version

Fig. 1. Airey Mark III forward-mounted tractor crane handling a skip of concrete

WHICH CAME FIRST, the improved method or the improved machine? This paraphrase of the well-known saying only needs to be stated for its point to be appreciated in relation to the building and civil engineering industries. The question came to mind as a result of a visit to the recent 13th Building Plant Exhibition—held in the London area for the first time. Clearly from the nature of the exhibits on show, it would seem that on the whole, new methods encourage new equipment trends. But that is not the whole truth of the matter, traditional building methods also continue; the tendency here is forward towards complete mechanization, even among smaller contractors.

This growing mechanization of traditional building methods is encouraging the development of plant and equipment which is more suited to the work in question than is traditional equipment. Not only is this equipment more productive; if properly used, it is generally capable of yielding higher quality workmanship.

The most important range of building and civil engineering plant and equipment at the moment however, would seem to be that designed to mechanize and expedite the execution of new building techniques and the application of new building materials, both on construction sites and in prefabrication factories. All this building and civil engineering plant and equipment possesses a common feature. It is largely mechanical handling equipment which has been adapted, modified or redesigned to suit modern building techniques. Or, specially designed to combine handling and new-type processing functions.

Mechanical handling engineers will note with great pleasure that mechanization in the building and civil engineering industries implies mechanization of handling to a very large extent and, in most cases handling linked with skilled craftsmanship.

One problem facing building contractors, particularly smaller contractors and one-man firms, is that of choosing between very large numbers of machines. For this reason many of them welcomed the opportunity of seeing building and earthmoving machinery at work, during the Building Plant Exhibition. The organizers, the Ministry of Works, held the exhibition on a 25-acre site at Greenford, Middlesex, and 12 acres of this was set aside for machinery demonstrations. The exhibition was held during the period June 10th to June 17th, and it was very well attended. It was supported by about 120 manufacturers and distributors of building plant and equipment and its aim was 'to show builders and building workers the latest machines and equipment available to speed construction and to help reduce building costs'. As might be expected, it also strongly propagated the essential principles of good materials handling.

Of equal significance was the statement of Lord Hailsham, Lord President of the Council, when he officially opened the exhibition: "There is so much small plant available, now well within the means of the small builder, that there is really no excuse for work not being fully mechanized. Too many people still look upon mechanical handling as something only the largest firms need or can afford. The opposite is the case. No builder can afford not to be mechanized, if

Fig. 3. Fiat ¾ cu. yd. model FL4 tractor-shovel, at work

he is to be fully competitive in the modern world". He went on to compare the 1959 exhibition with the first of its type, held 15 years ago. In those days the emphasis was upon small items, mainly hoists, skips, augers and concrete mixers, etc. Now the emphasis is upon monster tractors, tower cranes, scrapers, excavators, and other major items of equipment.

Many New Developments

Large numbers of new developments were exhibited. Mostly, these demonstrated the influence of contemporary methods and materials upon equipment trends. Other new developments were designed to satisfy the requirements of contractors employing old-established methods and materials.

In all, there were on show 12 main types of new development: cranes; tractors; dozers; loaders and shovels; weigh-batchers, vibrators and concreting equipment generally; compactors, trenchers, road machines; dumpers and trucks; conveyors and skips; cutters, drills, hammers and power tools; pumping equipment; scaffolding equipment; and sundry items. Of these, five were definitely mechanical handling equipment or earthmoving (materials handling) equipment. Many of the other sections include materials handling equipment of one kind or another, as well as processing equipment with built-in handling devices, or mobile plant designed to reduce materials handling requirements to a minimum.

Because of these facts, it could be claimed that new mechanical handling and other materials handling equipment probably greatly outweighed all other new equipment on show, both in numbers and in total value.

New Cranes

New and recently-developed cranes on show included those listed in Table 1. Mechanized building construction is very largely based upon economic handling and placing in position of structural steelwork, precast concrete beams, columns, floors and roofs, timber, concrete mixed on site or delivered ready-mixed, bricks and other cladding materials, as well as window frames, etc. The most general handling equipment employed is undoubtedly the crane, usually taking the form of a tower crane or a mobile crane, often supplemented by a winch or hoist, according to the nature of the job. The main exceptions are where dumpers or mono-rail systems are employed. There is, usually, a fairly clear-cut point where one type of equipment becomes more economical to use, rather than the other. This, however, is outside the scope of this report.

TABLE I
New or Recently-Introduced Cranes

Machine	Exhibitor
Champion 3D small tower crane, 1-ton load capacity, for 4-5 storey buildings	Cornelly Equipment Co. Ltd.
Allen K64 truck-mounted crane-excavator, which has the same turntable as model K52, with a re-designed chassis, single engine air-controlled clutches. Maximum lift, with extended outriggers, is 6 tons with 25-ft boom at 10-ft radius	John Allen & Sons (Oxford) Ltd.
Potain telescopic tower cranes	G. R. V. Briere
Fully-hydraulic mobile crane with precision control	Tunny Cranes Ltd.
Jones KL 12-20 mobile crane, with 4-wheel drive, diesel engine, direct transmission, giving 6-ton lift at 21 ft radius, using a 75-ft jib	Geo. Cohen Sons & Co. Ltd.
Buildmaster 3½-ton electric rail-mounted tower crane, lifting height 178 ft, 90 ft jib	Abelson & Co. (Engineers) Ltd.
Airey forward-mounted tractor-crane, Mark III	Witlor Ltd.
Smith ME.1 excavator crane of 22½-tons capacity at 10 ft radius	Thos. W. Ward Ltd.

Most ingeniously-simple of the new crane developments on show was that exhibited by Witlor Ltd., the Airey Mark III, forward-mounted tractor crane, illustrated in Fig. 1. The crane is really an attachment for use with Fordson Power Major industrial tractors. It fits in front of a tractor and runs on an additional pair of steering wheels. The jib is hydraulically-controlled and precision-lowered. Maximum load is 15 cwt, maximum radius is 11 ft 9 in, maximum lift is 22 ft. Operation is by means of a single-acting hydraulic cylinder working at 2,000 lb/in². Steering is by linkage from the tractor steering system. Travelling height with jib in down position is 16·3in, overall length with jib in down position is 19 ft.

The Tunny hydraulic crane is illustrated in Fig. 2. It is available as a tractor-trailed machine or lorry-mounted. The Tunny crane is a hydraulically slewed crane, constructed as a platform unit, with a derricking jib and steel wire rope hoist. It can be mounted on most types of lorry or four-wheel drive vehicle, without setting up excessive wheel loadings. This is due to the machine's very low overall weight. Hoisting and derricking is by means of double-acting cylinders, which incorporate safety devices. In case of power failure or pressure drop, these automatically lock the system until a repair can be made. Overhoisting and overlowering are automatically prevented and lowering is controlled under power. Maximum hoisting speed is 60 ft per min.

Slewing is by double-acting cylinder, automatically regulated through 300 deg. The crane is suitable for use in narrow openings, as the counterweights project 6-in beyond the sides of the vehicle. When used as a mobile crane, without outriggers, with a 16-ft jib, the new crane has a load capacity ranging from 12½ cwt at 15 ft 6 in radius, to 2 tons at 6 ft 9 in radius. With a 26-ft jib, load capacity ranges

(*continued on page* 489)

Fig. 4. Michigan 275A tractor shovel at work

Fig. 5. Carter Bambino 1-ton excavator-crane, wheel-mounted version

from 5 cwt at 22 ft radius, to 1 ton at 8 ft radius.

Earthmoving Equipment

Earthmoving and site clearing equipment on show included many new developments. Much of the equipment is already familiar to readers of *Mechanical Handling*. New and recently-developed tractors, dozers, loaders and shovels exhibited, included those listed in Table 2. Two interesting major trends were noticed: the development of larger and more powerful British-built earthmoving machinery, and the development of smaller and more versatile equipment of a similar type.

A third trend still in its infancy, but of possibly even greater significance, is the emergence of loaders and other handling devices essentially designed for building contractors, but capable of more universal applications. This is a parallel development to one which characterized British agricultural engineering some few years ago.

TABLE 2
New or Recently-introduced Earthmoving Equipment, etc.

Machine	Exhibitor
First British-made Allis-Chalmers Tracto-Loader	Mackay Industrial Equipment Ltd.
Fiat FL.4 tractor shovel	Mackay Industrial Equipment Ltd.
Allis-Chalmers HD.11B crawler tractor	Mackay Industrial Equipment Ltd.
British-built series H Caterpillar D8 crawler tractor	Fred Myers Ltd.
First British-built 4-wheel drive tractor shovel of its size to go into full production model BL 460T	Bray Construction Equipment Ltd.
Loadmaster 3000 loading shovel	Chaseside Engineering Co. Ltd.
Hi-speed D5 medium dumper	Chaseside Engineering Co. Ltd.
British-built Michigan 4-wheel drive loading shovels, models 55A and 125A, and backhoe attachments for these shovels	Michigan (Great Britain) Ltd.
More powerful Matbro Mastiff 4-wheel drive, 4-wheel steer centre-point articulated loading shovel	Mathew Brothers
International Harvester BTD-20 crawler tractor with Bullgrader and P.C.U.	Saville Tractors Ltd.
Merton frontloader model 59, two-wheel or four-wheel drive versions	Merton Engineering Co. Ltd.
Walker-Doe heavy duty ditcher and dyke cleaner	Ernest Doe & Son Ltd.

The British-built Michigan tractor shovels aroused considerable interest, both on the Michigan stand, and on the earthmoving plant demonstration site, where they put up impressive performances. Two models are at present made in the United Kingdom, model 55A, a 1 yd.^{3} machine, and model 125A, a 2¼ yd^3 machine, the firm responsible for manufacture being All-Wheel-Drive-Ltd., of Camberley, Surrey.

Both models are basically similar in general design, with four equal diameter wheels, 4-wheel drive, planetary-wheel axles, torque converters, hydraulic steering boosters, four speeds forward and four speeds in reverse, power-shift transmission, and low level bucket tip-back.

Another interesting machine was the latest model Carter *Bambino* 1-ton mobile crane-excavator, made by J. W. & T. H. Carter Ltd., Hull. This is one of the smallest machines in its class and is available mounted on crawler tracks or four pneumatic wheels. It is, in fact, a universal excavator similar to larger orthodox machines, but scaled down, it is very well engineered. Front-end equipment available includes the following: crane, grab, dragline, face shovel, backacter, skimmer.

Other Handling Equipment

Other new or recently developed mechanical handling and allied equipment shown at the Building Plant Exhibition is summarized in the selection listed in Table 3. This includes dumpers, conveyors, skips, and special-purpose trucks.

One of the most interesting of the special-purpose trucks exhibited was that shown by H. C. Slingsby Ltd. This was the Slingsby-D.S.I.R. *Brictruk*, for the handling of steel-strapped packaged bricks, usually in 50's. This method of delivering bricks and handling on site is gaining popularity amongst building contractors. By using such a truck and a Slingsby ramp, it is claimed that one man in 1 hour can safely unload 4,000 bricks from a lorry.

Another interesting special-purpose truck was shown by C. H. Johnson (Machinery) Ltd. This was really a dumper with detachable crane skip, ideal for handling site-mixed or ready-mixed concrete. It enables greater flexibility to be obtained from cranes on site. The new development is called a *Trip-Skip* and it is for automatically removing skips from Johnson diesel dumpers. Four operations can be carried out: automatic detaching of a loaded or unloaded crane skip from itself; automatic pick up of a loaded or unloaded crane skip; it allows a crane to pick up or replace a crane skip on to the Trip-Skip mechanism, while the dumper is away on other duties; it allows a crane to pick up or deposit a loaded or unloaded skip directly on to the dumper. The crane skip employed with the device is 18 ft^3 struck capacity.

Fig. 6. Delivery end of the Robel concrete conveyor system

TABLE 3
Other New and Recently Developed Handling and Allied Equipment

Machine	Exhibitor
Trip-Skip device	C. H. Johnson (Machinery) Ltd.
1/20 dumper	C. H. Johnson (Machinery) Ltd.
Congreve dumper, 15 cwt capacity	Slater & England Ltd.
Slingsby-D.S.I.R. Bricktruk	H. C. Slingsby Ltd.
Wickham Mark V dumper	Wickham Engineering Co. Ltd.
Abelson diesel dumper, 5/7 yd³ capacity, 105 b.h.p. engine, high tipping angle scow-ended rock body	Abelson Engineering Co. Ltd.
Ibbett variable height mobile belt loader with sealed bearing	Ibbett Engineering Co. Ltd.
Concrete handling system, comprising Fulflo feeder unit of 1 yd³ capacity, and Speedyfeeder 12-in conveyors	Wickham Engineering Co. Ltd.
Lightweight crane skip	Wickham Engineering Co. Ltd.
Automatic tipping cradle skip	British Hoist & Crane Co. Ltd.
Hydraulic Mono-Rail Transporter Mark II	Road Machines (Drayton) Ltd.
Loadascreen mobile belt feeder with single or double deck vibrating screen, screen for stone, coke, coal, gravel, building debris, etc.	Frederick Parker Ltd.
Thwaites hydraulically-controlled multi-skip dumper with 14 ft³ side discharge concrete pouring skip and 10 ft³ tipping skip	Neal, Wright & Co. Ltd.
Hydrocon Highlander 5-ton rotary hydraulic full circle slewing crane	Brown & Tawse Plant Ltd.
Robel articulated conveyors for concrete, etc.	Witlor Ltd.

The most interesting of the machines listed in Table 3 are briefly described below.

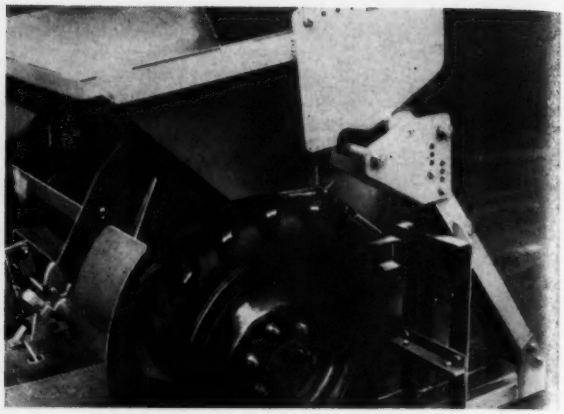


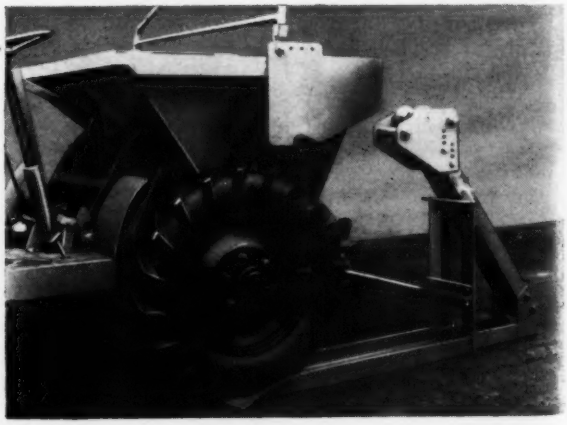
Fig. 8. This shows the action of the rollers on the Johnson ground frame shown in Fig. 7 when engaged with the camplates on the concrete skip. Note how the skip rides up so that it can be supported by the ground frame.

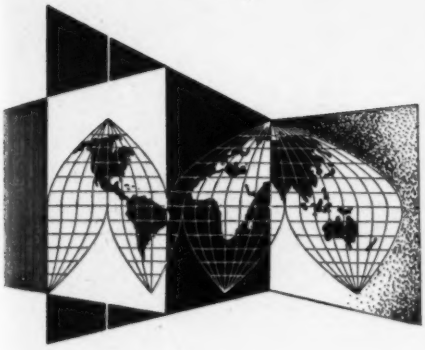
Wickham Engineering Co. Ltd. showed a new concrete conveying system, for the handling and placing of mass concrete where large foundations are involved. The system consists of a 1 yd³ capacity *Fulflo* feeder unit, which may be supplied with concrete directly from large mixers or rear tipping lorries or readymix lorries. The concrete is fed from the feeder on to one or more *Speedyfeeder* tubular conveyors in series. These conveyors can be mounted on skids, wheels, stands or scaffold tubing. The system enables concrete to be conveyed across sites where the presence of reinforcing steel would otherwise enforce use of cranes.

Of equal interest was the Robel articulated conveyor system, exhibited by Witlor Ltd., and illustrated in Fig. 6. This consists of a series of conveyors made by David Roberts & Co. (Engineers) Ltd., normally comprising three or four to a set. A four-unit set covers a radius of 72 ft. Additional units may be inserted to increase the radius of action. The conveyors are especially designed for the handling of low water content concrete, for which pumping is not suitable. Output is upwards of 16 yd³ of concrete per hour.

A third exhibit of great interest was shown by Road Machines (Drayton) Ltd., their new hydraulic Mono-Rail Transporter, Mark II. This consists of a powered wagon, driven by a 420 cc petrol enigne. Power is transmitted to two driving wheels by hydraulic motors, eliminating gear-boxes and resulting in improved performance. One or two trailers may be towed, depending upon the gradient.

Fig. 7. Johnson dumper with skip approaching the ground frame





BRITISH MECHANICAL HANDLING EQUIPMENT OVERSEAS

British mechanical handling equipment is to be found working in most countries of the world. Each year since the end of the war, sales to overseas customers have increased. Buyers from overseas flock to the Mechanical Handling Exhibitions (organized by this journal) held every two years in London, so great is the regard for British-made equipment.

In this feature, to be continued each month, we shall bring you brief details and illustrations of such British equipment designed for, or at work in, countries abroad.

Overseas readers requiring information on any type of British mechanical handling equipment, or names of manufacturers' agents or representatives in a particular country, are invited to write to the Editor.

EAST AFRICA. *A Lansing Bagnall FD diesel fork truck of* 1-*ton capacity working in the harbour at Mombasa, East Africa. The trailers are also made by these manufacturers and it will be noted that the Authority used the diesel truck also as a towing unit.*

SOUTH AFRICA. *Two of a fleet of Ransomes FL40 fork lift trucks working at Castle Brewery, Isando, Transvaal. Ransomes Sims & Jefferies Ltd.*

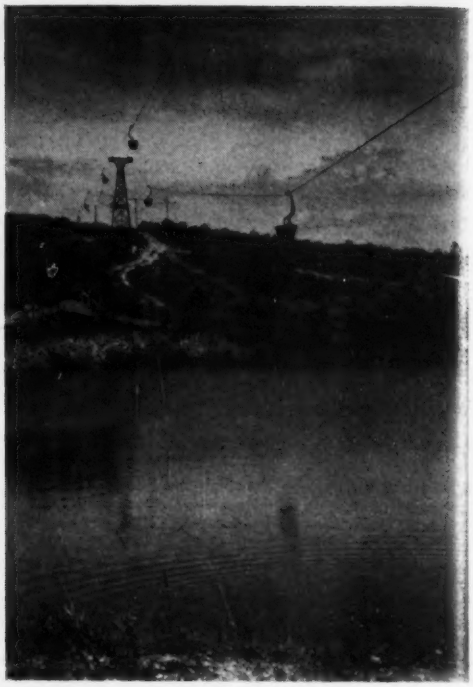
INDIA. *A Conveyancer E2-20 in operation in a tobacco factory in Saharanpur, Southern India. Conveyancer Fork Trucks Ltd.*

En la mayoría de os países del mundo puede hallarse funcionando equipo británico de manejo mecánico. Desde que terminó la guerra la venta de tal equipo a los compradores de ultramar ha venido aumentando sin cesar. Tan considerable es la estima enue qse tiene el equipo de fabricacion britanica en todo el mundo, que son numerosísimos los compradores extranjeros que se personan en Londres para visitar la Exposición de Manejo Mecánico (organizada por esta Revista) que se celebra cada dos años.

En esta sección, que aparecará todos los meses, les ofreceremos ligeros detalles e illustraciones de tal equipo británico diseñado para países extranjeros o funcionando en ellos.

Los lectores de ultramar que requieran información sobre cualquier equipo británico de manejo mecánico, o el nombre del agente o representante de los fabricantes en cualquier país en particular pueden escribir pidiéndola al Director de esta Revista.

BRAZIL. *A mono cable ropeway crossing a river in Brazil. British Ropeway Engineering Co. Ltd.*



ITALY. *Picture shows an installation supplied by J. Collis & Sons Ltd. in a modern despatch system of a well known pharmaceutical manufacturer in Milan.*

Le matériel britannique de manutention mécanique se trouve en service dans la plupart des pays du monde. Chaque année, depuis la fin de la guerre, le chiffre des ventes à la clientèle des pays d'outremer s'est accru. Des acheteurs venus de tous les pays du monde accourent aux Expositions de la Manutention Mécanique (organisées par notre publication), qui ont lieu tous les deux ans à Londres, si haute est l'estime que l'on a pour le matériel de fabrication anglaise.

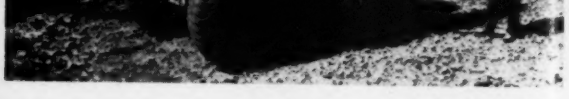
Dans cet article, à suivre tous le mois, nous vous présenterons des détails succincts et des illustrations du matériel anglais spécialemen des détails succincts et des illustrations du matériel anglais spécialement étudié pour et mis en service dans les pays étrangers.

Nous invitons cordialement les lecteurs de l'étranger à écrire à notre Rédacteur en Chef (The Editor) pour tous renseignements concernant un type quelconque de matériel anglais de manutention mécanique, ou les noms de fabricants, agents distributeurs ou représentants dans un pays donné.

Britische Förder- und Hebegeräte befinden sich in den meisten Ländern der Erde im Einsatz. Seit Kriegsende steigern sich die Verkaufsziffern an ausländische Abnehmer von Jahr zu Jahr. Ein so grosses Ansehen geniessen Geräte britischer Herstellung, dass ausländische Käufer anlässlich der alle zwei Jahre von dieser Zeitschrift in London veranstalteten förder- und hebetechnischen Ausstellungen in Strömen herbeikommen.

In dieser monatlich fortgesetzten Artikelserie werden wir kurzgefasste Einzelheiten und Abbildungen britischer Geräte bringen, welche für das Ausland konstruiert bzw. dort bereits im Einsatz sind.

Ausländische Leser, welche an Auskünften über britische Förder- und Hebegeräte gleichwelcher Art, bzw. an Namen und Adressen der entsprechenden Hersteller, Agenten und Vertreter in irgend einem gegebenen Lande interessiert sind, werden gebeten, sich schriftlich an die Redaktion zu wenden.



SPAIN. *An Aveling-Barford 4½ cu. yd. diesel dumper fitted with a Perkins L4(1) industrial diesel engine, at work in the Rio Tinto mine in Spain.*

BRITISH GUIANA. *A standard Ferguson FE35 petrol tractor towing a trailer loaded with a Priestman 'Tiger' dragline. Massey-Harris-Ferguson (Sales) Ltd. and Priestman Brothers Ltd.*

REVIEW OF NEW EQUIPMENT

DRUM-TYPE MAGNETIC SEPARATOR

Introduced at the recent Foundry Trades Exhibition by Electromagnets, Ltd., Boxmag Works, Bond Street, Birmingham 19, the new Boxmag superflux magnetic, drum-type separator is of enclosed design. It is fitted with a super-intensity magnetic drum, embodying 'Alcomax' permanent magnet alloy units with superior properties obtained by creating a preferred axis of magnetization by adjusting the atomic structure through heat treatment in the magnetic field. The magnets are stabilized and should not depreciate more than 5 per cent in 10 years.

The magnet units are mounted inside a drum fitted with a rolled stainless steel cover with suitable ribs to aid separation and mounted on non-magnetic end flanges on bronze bearings fitted to a steel shaft. The drum is driven at 25 r.p.m. by V-belt and totally enclosed geared reduction motor inside the casing. It is fed by a vibratory tray fitted with rotary vibrator and resiliently mounted to prevent vibration being transmitted to the frame. The vibratory and geared driving motors are wound for 3-phase, 50 cycles current and controlled from a single push-button starter provided with an entry gland. The machine is built into a fabricated steel plate framework with rear support by a steel tube mounting flange.

The latest Boxmag drum-type magnetic separator with vibratory feed tray

A machinery slide fitted with Schneeberger roller linear bearings

BALL AND ROLLER LINEAR BEARINGS

Applicable to many types of machine tools, machinery, equipment and jigs, replacing conventional slides, the Swiss Schneeberger roller and ball linear bearings are now available in this country. They consist of hardened and ground tracks and crossed roller chains or caged balls. The tracks are of special alloy steel, heat-treated to give great hardness and stability, and made in six standard sections, with length and fixing holes to suit requirements. To ensure perfect functioning, they are made to tolerances of 0·00001 in per every 2 in of length. By a special technique the rollers or balls are of matched sets to the most precise tolerances. For designers requiring a slide with a long stroke in relation to length of slide, a special type consists essentially of a crossed roller chain made endless, supported by pulleys and running on tracks.

The sole distributors for the U.K. and Commonwealth are Engineering and Scientific Equipment, Ltd., Coronet House, 287-289 Old Street, London, E.C.1.

WATER-COOLED FLAME-PROOF MOTOR

For mining application, the Electric Motors Division of Newman Industries, Ltd., Terminal House, Grosvenor Gardens, London, S.W.1., has developed a flame-proof motor which is water-cooled and, though equalling conventional design in performance, in cross-section takes up only half the area. It is continuously rated at 75 h.p. at 1,470 r.p.m. on a 50-cycle 3-phase supply. The starting and breakdown torques are twice the full-load value, and the starting current 4½ times the full-load current when switched direct on line.

The motor is Class 'B' insulated, but with 5 gallons of cooling water flowing per minute, temperature rise, measured by change of resistance method, does not exceed 55 deg C, and is therefore well within Class 'A' limits.

Construction is all steel. The water jacket round the stator is complete in itself, designed for working pressures up to 500 lb/sq. in., and there is no danger of water leakage into the motor. Grease-lubricated ball and roller bearings are fitted. A thermostat mounted on the windings has its leads brought into the terminal box for connecting in the control circuit as a precaution against overloading or the winding reaching too high a temperature should the water supply be cut off.

INVERTED INDUCTION MOTOR AND ALTERNATOR

Though designed for operating an electrostatic generator for atomic energy research, the inverted induction motor and alternator developed recently by Newman Industries, Ltd., are also suitable for other applications.

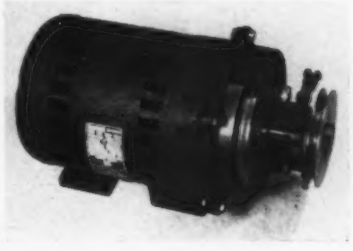
The motor is a 4-pole 3-phase squirrel cage machine, developing 10 h.p. continuous rating at 1,460 r.p.m. on a 50-cycle supply. Locked rotor current switched direct on line is 80 amps. at 400 volts, and locked rotor torque is 110 per cent full load torque.

The alternator comprises three separate inverted permanent magnet-type single-phase alternators, each continuously rated at 115 volts 500 VA 0·8 P.F. 194 when running at 1,460 r.p.m. The permanent magnet field system is air stabilized and the stability of the system is not impaired, therefore, by a momentry short circuit or when the unit is disassembled and the armature withdrawn.

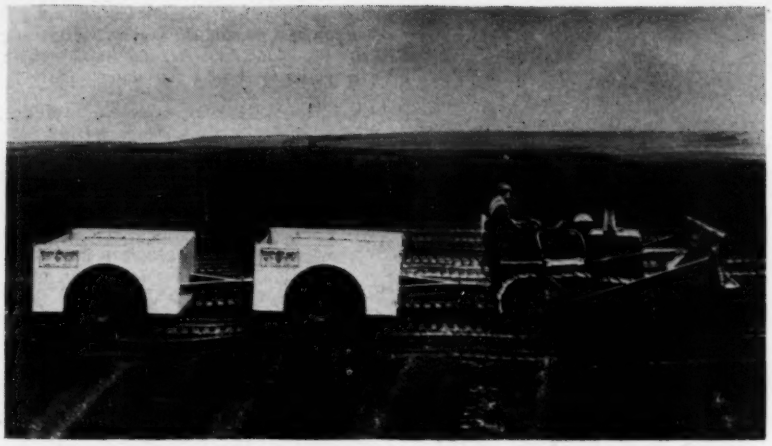
Both motor and alternator are fitted with grease-lubricated single shielded ball bearings, lightly preloaded to give quiet, smooth running. Rotating parts are dynamically balanced to precision limits.

NEW CLUTCH UNIT

The latest addition to the range of clutch units manufactured by the Marine Engineering Co. (Stockport), Ltd., Bulkeley Street, Edgeley, Stockport, is the enclosed design Mardrive clutch motor. It uses a purpose-built Crompton Parkinson f.h.p. motor and is intended for use on high-speed coil winders, instrument lathes, conveyors, sewing machines, etc. It provides variable speed facilities as part of its regular function, and gives slow and very sensitive or extremely quick starting according to installation requirements. Principal features include low weight, compact design, a flywheel specifically designed to match the run-up torque and load factor of the C.P. motor, a completely detachable clutch and an adjustable control for rate of acceleration and braking.



The new Mardrive clutch unit with end cover removed



A Terrafirmer trailer compactor in operation

TRAILER COMPACTOR

A pre-cast reinforced concrete body is a patented feature of the new Terrafirmer trailer compactor, and its weight does away with the need for loading additional weight before use. It is suitable for any kind of materials compaction in applications ranging from road making to coal stocking. It consists of two articulated units, one with four and the other with five wheels, carried in staggered positions to ensure uniform consolidation over the ground covered. By having two interconnected units the number of working parts is reduced, and the compactor is more easily transportable.

Suspension is by cranked axles mounted in phosphor-bronze bearings. The axles are double cranked, with a total throw of 4 in or 7 in as required, thereby imparting exactly equal loading to the ground without departing from a straight path. The fifth wheel, suspended from a beam mounted on rubber blocks in shear, ensures continuous pressure on the formation. The compaction width is 6 ft 10 in. Tyre loadings range from 2,240 lb per wheel when unloaded to 3,360 lb when loaded with ballast in compartments provided. The outside turning radius is 24 ft. 6 in. Drawbar height is adjustable, and balanced loading of the carriages minimizes vertical loading on the prime mover.

Manufacturers are William Jones, Ltd., 1 Fitzroy Square, London, W.1.

CONCRETE PREPARATION PLANTS

As demonstrated by the use of over 2,000 installations by prominent German civil engineering contractors, only two men are required for the production of concrete by a combination of plant marketed by A.C.E. Machinery, Ltd., Porden Road, Brixton, London, S.W.2. The combination comprises an Ace batching star, scraper weigh bin and cement screw balance with which batching preparation of concrete can be carried out at ground level as distinct from feeding elevated aggregate bins by crane or high-discharge loaders.

There are many varying combinations of these and other Ace equipments available that can be employed according to the size and needs of the contract. It is advised that the smaller contractor would find it most economical to have an Ace batching star fed by an Ace Dalli hand-scraper. For the large contractor the Ace radial scraper is recommended. It is stated that for larger constructions an output of 46 cu yd./hr is given by a combination of a star batcher with four compartments, a weigh silo and a radial scraper with, if required, an automatic cement screw conveyor and weigher. By means of the Flexiball system, the controls for all discharge doors can be remotely operated from the mixer platform, which enables the mixer operator to carry out all pouring operations, the only other operator needed being able to maintain the feeding of aggregates from within the cab of the radial scraper.

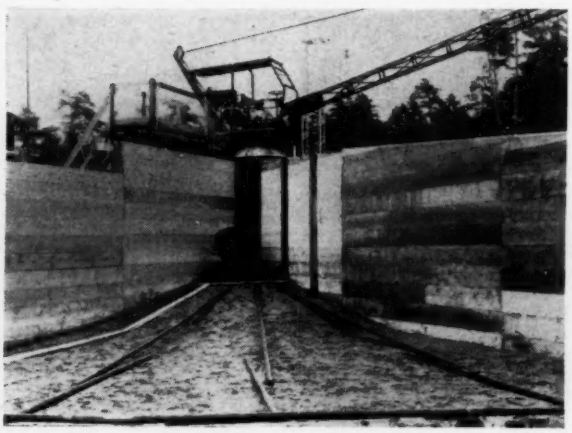
FORK LIFT STRADDLE CARRIER

Recently included in the range of straddle carriers produced by Valmet Oy, Helsinki, Finland, is the new model C.C. on which four steel forks, as used on fork lift trucks, displace the customary hydraulically opening, closing and lifting load hooks and eliminate the timber or steel bolsters which must be transported with the load by normal straddle carriers.

Located below each side chassis member are two forks in longitudinal alignment a few inches above ground when the carrier is without a load. To pick up a load, which must be supported on dunnage strips to give under-clearance, it is straddled by the carrier in the normal manner. The driver then turns each pair of forks inwards simultaneously so that they almost meet under the load, and raises them vertically until the load reaches the desired travelling height, preferably pressed against the underpart of the superstructure. These operations are performed hydraulically, controlled by two levers. For use particularly when the load is narrower than the load aperture, two steel stabilizers, or fins, are fitted, one on each side below the superstructure. These can be turned inwards hydraulically to grip the load on both sides at a pressure that can be varied to obviate damage.

continued on page 495

A typical Ace ground level concrete production installation



A Finnish Valmet fork-lift straddle carrier, showing the steel stabilizing fins gripping the load of timber

The load is thus gripped firmly at the top, bottom and sides, eliminating risk of accident in the event of emergency braking. The forks are automatically locked in position when transporting a load and automatically unlocked when they are lowered for discharging.

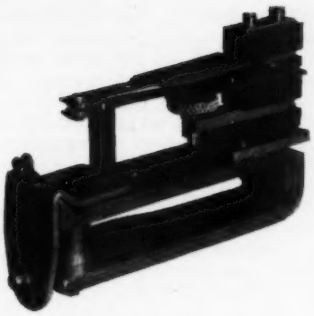
All the main components of the carrier are made in Great Britain, including the Perkins P.6 70-b.h.p. diesel engine, power-assisted steering, David Brown gearbox, Borg & Beck clutch, Bendix hydraulic brakes, Plessey hydraulic pump, Sankey steel wheels and Renold chains.

The sole concessionaires for the Valmet straddle carriers in the United Kingdom and British Commonwealth are Materials Handling Equipment (Great Britain), Ltd., 40A Dover Street, London, W.1.

SELECTOR CONVEYOR

Said to be the first British product of its kind, the new ALM 'Masterveyor' unit band conveyor has a selecting and ejecting device, particularly suitable where goods are made up or assembled and placed into containers for passing automatically on to operatives. For example, where individual workers are responsible for one operation in a series it is necessary to convey work to and from each in lots and yet still tie up the production sequence of several operations. This conveyor will carry containers, and the ejecting mechanism will automatically discharge them sideways to the operative at the required station. Almost any number of stations can be incorporated.

The conveyor has two tiers. Containers of work can be sent out by the feeder on the top tier, and they are returned to him underneath with the work completed. By the addition of a powered inclined section containers can be returned to the top tier, permitting the operative-to-operative principle to be used. Selection of station is simple. A pointer on the container is set according to the station required, and on arrival there a trip is actuated and the container is delivered to a side table. There is room for two containers on the table per station, and another trip isolates the ejector when the two containers are in position. Inclined tables on each side run the whole length of the conveyor. An indicator enables an operative to signal to the feeder when work is wanted.



A Londex type BZ/SQ busbar relay

Manufacturers are A. L. Marshall (Carlton), Ltd., Carlton, Nottingham.

D.C. BUSBAR RELAYS

A new range of relays for busbar applications is announced by Londex, Ltd., Anerley Works, 207 Anerley Road, London, S.E.10. For use generally to provide an indication of heavy current flowing in a busbar, types BZ/R and BZ/SQ can also be used as an overload device to trip at a pre-set figure. No conventional coil is employed, thus eliminating possible failures through sustained overloads. A yoke is clamped around the conductor in such a way as not to disturb the existing insulation. Each relay has a set of normally open 6mm silver contacts capable of handling 4 amps at 250 volts A.C., and an adjusting screw to set the operating figure within the ranges quoted for each type. Both types can be fitted with a pneumatic damper to give a half-second delay so that high transient currents would not cause them to operate.

Type BZ/SQ has a yoke for clamping to rectangular section conductors not exceeding 2 in × $\frac{1}{2}$ in, and six models cover ranges 100-200 amps to 600-1,100 amps D.C. For circular conductors up to $\frac{3}{4}$ in dia, three models of type BZ/R cover ranges of 70-100 amps to 200-400 amps D.C.

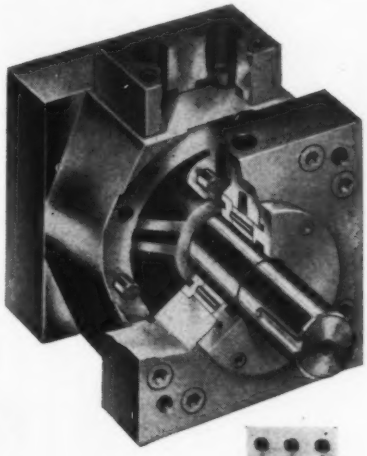
Another relay, type BZ/MR/HC/SQ, provides positive indication of a back-fire in high current mercury rectifier systems or wherever reversal of current is to be indicated. The standard model withstands sustained forward and reverse currents up to 20,000 amps and will trip when the reverse current exceeds 6,000 amps with a fault current whose rise time is $3{\cdot}6 \times 10^6$ amp/sec. The speed of contact operation is less than 10 milliseconds. It can accommodate any size of busbar up to $2\frac{1}{4}$ in × 1 in.

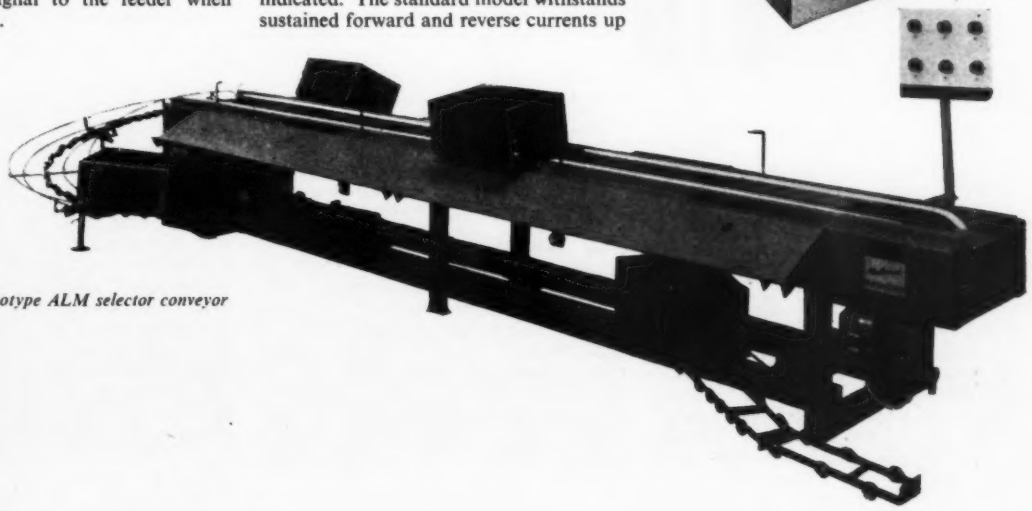
HYDRAULICALLY CONTROLLED TORQUE ACTUATORS

Keelavite Hydraulics, Ltd., Allesley, Coventry, have concluded an agreement to manufacture and sell in Europe and the U.K. the Rotac rotary torque actuator units of the Ex-Cell-O Corporation of America. These compact, powerful units provide semi-rotary movement, hydraulically controlled, for automation equipment and machine tools, operating valves, actuating hatches and watertight doors on shipboard, for cranes and many other uses.

The first to be made in this country are the RN series single- and double-vane units, fitted with needle-roller bearings and with torque ratings ranging from 1,500 in/lb to 92,000 in/lb at 1,000 p.s.i. The single-vane models allow movement through an arc of 280 degrees. The double-vane models develop much greater torque for the same pressure, but the arc of movement is restricted to 100 degrees.

Sectioned view of a single-vane Keelavite-Rotac rotary torque actuator with roller bearings

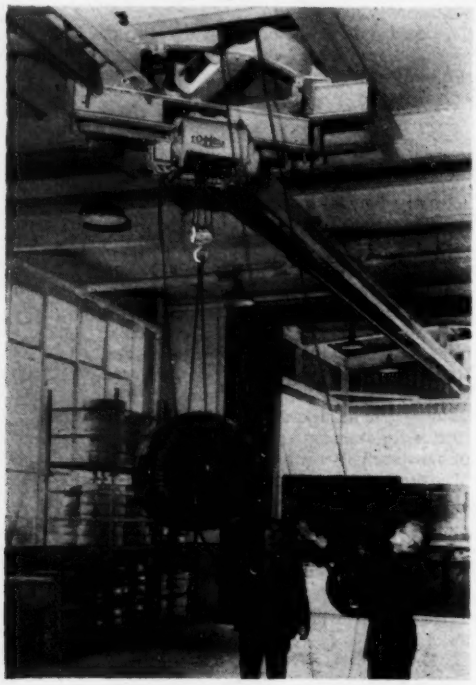




A six-station prototype ALM selector conveyor

They can be mounted vertically, horizontally or at any other angle, are controlled by hydraulic valves, and movement can be stopped, started, slowed down or speeded up as required. The arc of travel can also be controlled by valves or by positive stops.

A Taylor Stoker electric hoist and turntable installation in use for loading a reel of cable on to a railway wagon



LISTER DIESEL DEVELOPMENTS

The Lister Group of Companies, Dursley, Glos., announce that their HA2 and HA3 air-cooled diesel engines are now rated at 22 h.p. and 33 h.p. respectively at 1,800 r.p.m. They are also available with higher speeds up to a maximum of 2,000 r.p.m., when they are known as types HB2 and HB3, developing 24 h.p. and 36 h.p. respectively at 2,000 r.p.m.

The well-known Lister 6/1 diesel engine has now been developed in an air-cooled version, type VA, to give from 5·75 h.p. at 650 r.p.m. to 7·5 h.p. at 850 r.p.m.

ELECTRIC HOIST AND TURNTABLE

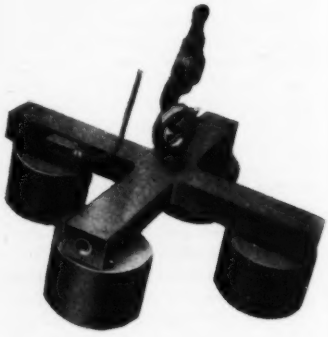
An electric hoist installation that can be usefully applied to many industries is that supplied and erected for Standard Telephones & Cables, Ltd., at Newport, Mon., by Taylor Stoker Co., Ltd., 189-191 Drummond Street, Euston, London, N.W.1.

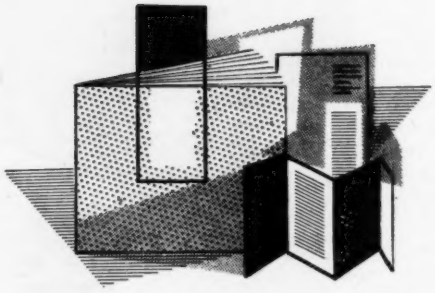
The overhead runway equipment, comprising several runway beams with two turntables at the junctions, complete with guarded power track, enables the Lo-Hed hoist to serve four entrances to the new despatch department. The hoist is mounted on the movable section of beam which has wheels for running on a circular track. The movable section is rotated by hand chain to engage it with one or other of the runways which cross at right angles. Automatic stops prevent the hoist from running off any open end of runway while transferring from one to another. The hoist has a lifting and lowering speed of 20 ft/min, operated from a pendant push-button station suspended from the hoist on a heavy flexible cable.

CLOVER-LEAF LIFTING MAGNET

To facilitate the handling of coiled mild-steel strip and the like, Rapid Magnetic Machines, Ltd., Lombard Street, Birmingham, have introduced a new type of lifting magnet. It consists of a number of magnets mounted on a common framework, and adjustable so as to cover coils of various diameters. To cover a wide range of coils, it has hitherto been necessary to employ large-diameter magnets which are unwieldy and uneconomical. The new unit provides not only an economical answer to the problem, but also removes the possibilities of damage, common when using slings and mechanical grabs.

The new clover-leaf lifting magnet introduced by Rapid Magnetic Machines, Ltd.





ABSTRACTS AND REFERENCES

Articles on mechanical handling published in all technical and industrial journals of the world are indexed and abstracted below. Whenever it is known, the published price of the journal containing the article is given.

The addresses of the publications concerned are given and applications for copies of the journals mentioned should be made direct.

TRANSFER FIXING ON FIRE EXTINGUISHERS

Pneumatic Handling Jig. *Target*, Hercules Road, Westminster Bridge Road, London, S.E.1. May, 1959. P. 8. Controlled circulation.

To facilitate handling fire extinguishers during transfer fixing, each is slid on to a pneumatic jig with its handle against the backboard, secured by a wooden latch dropped through it. A lever on the left actuates a pneumatic ram which lifts the extinguisher to a convenient working height. A hinged wooden flap can be folded against the cylinder to indicate exactly where the transfer should be fixed.

LOW-TEMPERATURE AIR COMPRESSING

Portable Rotary Screw Compressors. *The Engineers' Digest*, 120 Wigmore Street, London, W.1. December, 1958. P. 533. 4s. 6d.

By the use of oil cooling, without intercoolers and after-coolers, a range of portable rotary screw compressors, with outputs from 135 to 600 cu. ft./min, are said to deliver air at temperatures at least 100 deg F lower than those obtained from conventional compressors. Oil injection cools the air during compression. It is then recovered, cooled, and returned to circulation, passing through a dual-purpose radiator which cools the engine circulating water. Two helical-fluted intermeshing rotors draw air in through the inlet port to fill the interlobe space. It is then trapped and compressed, with a progressive reduction in the volume of the space until released into the discharge port. The 4-lobe male rotor absorbs practically all the power required, while the 6-lobe female rotor functions as a rotary valve with continuous piston effect. The air flow through the compressor has axial-flow characteristics, and only the delivery end is subjected to high pressure.

(*continued on page* 497)

LIFTING SLUDGE

Automatic Capstan for Sludge Handling. *Compressed Air and Hydraulics*, St. Richard's House, Eversholt Street, London, N.W.1. May, 1959. P. 183.

A portable pneumatic capstan winch for hoisting sludge buckets from ships' tanks is described. It is powered by a 4-cylinder vee motor and, with a working pressure of 80 lb/sq. in., will lift 300 lb at a maximum speed of 80 ft/min with an air consumption of 40 cu. ft. of free air per minute. It has an aluminium capstan head and is easily mounted over hatches on a tripod or other frame erection without welded or bolted brackets, and can be controlled by hand or foot. After testing, it is stated, this type of winch is to be supplied for the entire fleet of the Standard Vacuum Transportation Co.

FOR EASIER VAN LOAD HANDLING

Un Camion-Chameau. *Manutention*, 40 Rue du Colisee, Paris 8, France. May, 1959. P. 125. 500 fr. (France), 600 fr. (countries outside France).

A brief description is given of a 5-ton delivery van, designed for quick and easy loading and unloading, employed by an American railway express agency. It is stated that by its use town delivery time can be reduced by 75 per cent. The body of the vehicle has roll shutter side and rear doors and can be lowered, raised and tilted for loading and unloading over a ramp manually or by hand truck at ground level or alongside a loading platform up to 52 in high. All movements are controlled from a panel at the rear end.

PACKING SUGAR

High-Speed Sugar-Packaging Machine. *The Engineers' Digest*, 120 Wigmore Street, London, W.1. P. 533. 4s. 6d.

By a special process of closing and sift-proof sealing, 1-lb and 2-lb sugar bags are given a particularly neat rectangular appearance by a new high-speed weighing and packaging machine. Besides saving labour and floor space, by using six weighers it is said that 120 bags can be packed per minute. After being automatically weighed to fine limits, the sugar is fed into the bags and settled by controlled vibration. They are then sealed, discharged into a drying unit, collated and fed into a parcelling unit where 14 2-lb bags are automatically packed for despatch. All processes after sealing are effected pneumatically.

SAVING SAW PRODUCTION TIME

Three-in-One Plant Reduces Handling. *Target*, Hercules Road, Westminster Bridge Road, London, S.E.1. May, 1959. P. 7. Controlled circulation.

Final stages of saw manufacture have been speeded up by carrying out the three dipping operations—stress-relieving, cleaning and lacquering—after etching and before fitting the handles, instead of, as previously, having to transport the saws from the main shop to another building after etching and returning them for cleaning and lacquering. The three-stage dipping plant installed in the main shop has a slotted angle framework accommodating three large tanks. Overhead rails carry three trolleys over the full length of the tanks, enabling the bogies to engage with three hydraulically operated lifts controlled to give a constant speed of lowering and withdrawal out of the solutions. The plant can deal with 150 dozen saw blanks per day.

FEEDING PRESSES

Automatic Feeder Handles Sheets and Plates. *Plant Engineering*, 308 E. James Street, Barrington, Illinois, U.S.A. May, 1959. P. 188. $1.

This is a device that will pick up stacked metal sheets and plates one at a time, place them on a table of driven rollers, align them with dies and feed them into a press. Operation can be continuous or intermittent, under one-man control. It consists of a table of I beams, having adjustable side guides to help the crane operator to locate the stack of sheets in alignment with the machine. The sheets are raised by a vacuum lifting mechanism supported by pivoting arms which swing back when each sheet is released to pick up the next.

FORK-LIFT MOBILE FLOOR CRANE

Chain Hook Increases Usefulness of Fork-Lift Truck. Practical Idea by R. G. Cavaiani. *Metalworking Production*, 95 Farringdon Street, London, E.C.4. May 15th, 1959. P. 868. 1s. 3d.

A simple addition to a fork lift truck is described, enabling it to lift and carry loaded tote boxes from one section of a shop to another where the installation of hoisting equipment is not warranted and they are too heavy to be handled by one man. This consists merely of fitting a chain hook to either of the truck forks. A 1½-in hole is burnt through the forks, about 4 in from their ends, and the chain is passed through one of them from the underside and locked at any desired height by slipping under a link a forked key made from steel plate about 3 in wide and 8 in long. A slot, about 5 in long and wide enough to slip over a link, is sawn out of the centre of the key, its open end is widened to permit easy entry and the other end is recessed to form a seat for a link.

VACUUM LIFTER

Square Cup Vacuum Lifter. *Distribution Age*, Chestnut and 56th Streets, Philadelphia 39, Pa., U.S.A. April, 1959. P. 44. 75c.

A square cup vacuum lifter for handling steel and non-ferrous plates is briefly described. It has two 20-in square vacuum cups, each with 400 sq. in. of lifting surface and with 4,000 lb lifting power. It is fitted with a pump capable of maintaining 27 in of vacuum.

FEEDING METAL STRIP TO PRESSES

B.H.P. Grip-Feed. *Metalworking Production*, 95 Farringdon Street, London, E.C.4. May 8th, 1959. P. 828. 1s. 3d.

Readily removed from one press to another, this metal strip feeder attachment is air-operated, can be set to feed from all directions and be adjusted to suit different tool heights. By means of gauge blocks, the stroke can be adjusted to any length up to 6 in, and a roller supports the strip on the ingoing side. When piloted tools are used, the feeder can be free of the material when they take over, and a pad brake prevents the material from falling back. By a pitch and trip system, the strip can be moved forward to an exact position, and the press be automatically tripped if required. Feeding at the full 6-in pitch, press speeds up to 120 r.p.m. have been accomplished.

CORRECT WORKING HEIGHT TABLE

Zeeta Lifting Table. *Metalworking Production*, 95 Farringdon Street, London, E.C.4. May 22nd, 1959. P. 917. 1s. 3d.

For presenting materials at the correct height to facilitate working and minimize handling, this table, available in 500-lb, 2,000-lb and 4,000-lb capacities for portable or stationary use, is powered by a ⅛-h.p. motor and controlled by an electro-hydraulic pump. Either foot lever- or hand-operated models are supplied. Lifting is effected through scissors-type linkage by the hydraulic cylinder. The portable model, with minimum closed height of 7⅜ in, can be placed under any standard pallet and be raised up to 37¼ in. It has fixed wheels, a pull plate and easily detachable skid spotter or dolly. The stationary model is intended for recessed installation, and can be lowered to floor level in a 7-in excavation and be raised to a height of 30 in above it.

DRY BULK CONVEYANCE

Double Worm Pump. *Monthly Technical Review*, VEB Verlag Technik, Oranienburger Strasse 13-14, Berlin C2, Germany. May, 1959. P. 117.

A brief description is given of a new design of pump for conveying dry powdered bulk materials, such as cement, raw flour and coal dust. Two separately operating screws feed the material into a central mixing chamber connected to a conveying pipe-line common to both. The drive is by electric motor through a clutch on the driving worm shaft. Its output, with worm speed of about 1,000 r.p.m., is given as 100m³/hr, as compared with 40m³/hr of worm pumps operating with a single conveying screw.

RECENT PATENTS

The following are brief extracts of recent United Kingdom patents which we believe will interest our readers. For full details the original patent specifications should be consulted at, or bought (3s. 6d. each) from, The Patents Office, Southampton Buildings, Chancery Lane, London, W.C.2.

PALLETS
Fisher & Ludlow, Ltd., Birmingham.—U.K. 810693.

Stillage racks for small space storage, with flange openings at small intervals to give variations of bracket position.

GRANULE SPREADER
Trafik Vagmarken A.B., of Stockholm.—U.K. 810696.

Sand spreader for streets, or fertilizer for fields, using elastic bands on the floor, tensioned to give stepped ejection.

CLOTHES CONVEYOR
Aktiebolaget Valida Maskiner, of Sweden.—U.K. 810699.

A form of suspended carrier for clothes hangers in factory.

POWDER TRANSPORT
Duramin Engineering Co., of Park Royal.—U.K. 810743.

Bulk granule transport using an air flow conveyor along with a tipping body with removable canopy, to give wide utility for the lorry.

BAG TYING
C. R. Leighton, of Maine.—U.K. 810708.

A tacky tape bag tying machine with rotary tape supply reel co-operating with notches in a rotating wheel to finish off the tie.

BALER
Bamfords, Ltd., of Uttoxeter.—U.K. 810775.

Baler-compressor with size detected by a metering wheel which then operates the tying mechanism—via a lever.

PACKER
Emhart Manufacturing Co., Connecticut.—U.K. 810795.

An automatic machine packer for gable top milk containers, put in groups into cases, using load grip holders.

WRAPPER MACHINE
F. D. Bate, of Nelson, Lancs.—U.K. 810811.

A simpler turret or wheel type wrapper device for fragile matter such as swiss rolls or sausages, which is not wholly automatic but can deal with uneven surfaces such as biscuit stacks and uses fingers for wrapper folding.

CONVEYOR BELT
Greengale & Irwell Rubber Co., of Salford.—U.K. 810841.

A p.v.c. copolymer with butadiene and acrylonitrile is suggested for fire-resistant conveyor belts, which have carbon black included to make them anti-static, along with a phosphate ester plasticizer.

CIGARETTE DRYING

Trays are supported on hangers at several levels, using a feeder chain conveyor for warm air drying of cigarettes, etc.

COLLAPSIBLE TROLLEYS
R. C. L. Rayment, of Peckham.—U.K. 810882.

A folding trolley for dairy use, etc., carrying bottles, comprising a wheeled folding frame.

PALLET
M. Markussen, of Bergen.—U.K. 810907.

Piece good ship transportation pallet for lift truck or crane use, with some easily removable, but normally locked sides, held by quick-release slot and pins, but releasable even against side pressure.

STOCK DISTRIBUTOR
Tan Tesch A.B., of Stockholm.—U.K. 810928.

A blast furnace stock distributor with a series of bells of frusto-conical shape, sealing against gas loss, but easily maintained.

LOAD HANDLER
S.I.C.A.M., of Lyon.—U.K. 810941/2.

A rocking platform is used with pivoted arm to carry the skip, etc., having hydraulic control via a jack, the reversible motor having a given form of wheel lubrication.

BOOM CRANE
Baldwin Lima Hamilton Corporation, of Philadelphia.—U.K. 810952.

Design of crane for use on truck, rail car or tractor, with full circle boom movement, which can revolve and raise or lower at the same time.

STORAGE GARAGES
G. W. Carr, of Fife.—U.K. 810981.

A design of helical tower garage for car storage, with a central lift.

RAIL CREEPER
Coal Industry Patents, Ltd., of London.—U.K. 810983.

Mine car creeper with endless chain co-operating with an engagement fixture on the tub, which can be spring loaded.

PAPER DRYING
Fram Corporation, Rhode Island.—U.K. 811052.

High speed conveyor for curing of pleated resin-impregnated filter paper at up to a quarter million pleats per hour, an inch high with high velocity hot air jets directed from above at 450 deg F giving complete drying in 30 seconds, without fire hazard or resin migration trouble.

CUTTER LOADER
Mavor & Coulson, Ltd., of Glasgow.—U.K. 811059.

Thin seam coal, etc., chain-powered cutter-loader with transverse outward discharge at a low level, the loader jib carrying the cutter above, and the drives being interconnected.

EXTENSIBLE MASTS
Union Joinery & Importing Co., Ltd., of Johannesburg.—U.K. 811075.

For carrying booms for cranes, concrete conveyors, bridges, etc., giving a minimum time for mast jacking of the sleeve hoist, by means of direction-changing pulleys for each hoist, preferably at the outer corners, below each hoist, to reduce the pulley mass and spreading the load evenly at all times.

PNEUMATIC CONTROL
A. B. Svenska Flaktfabriken, Stockholm.—U.K. 811092.

A supply cut-off control if disturbances occur in pneumatic conveyors, e.g., of grain, somewhat as per Patent 700742, using automatic governing of feed via valves and throttles operated by air line pressures.

STRETCHER CLOTH
Aktiebolgat Sangfabriken, Stockholm.—U.K. 811887.

A stretcher frame cloth made of two bag-shaped portions of fabric with corner recesses and apertures, interfitting.

PEAT STACKER
Heseper Tarfwerk G.m.b.H., of Germany.—U.K. 793284.

A re-issued amended patent for an automatic peat cutting and stacking self-propelled machine on four caterpiller tracks, the jib being able to remove overlay or burden.

WHEELED CRANES
J. A. Whittall, of Bewdley.—U.K. 809926.

Propelled by hitching to the front of a tractor, steered by it, the boom fits back on to the rear of the tractor.

FLOOR CONVEYOR
Geo. W. King, of Stevenage.—U.K. 810426.

A non-swivel type wheeled floor conveyor with releasable chain-drawn trucks—an aid round sharp corners by rolling support. Patent 807802 is mentioned.

WHEELBARROW
Mastermet Products, Ltd., of Harrow.—U.K. 810467.

Strong cheap barrow made from pressed metal sheet components, with beaded wire edges and a mud scraper which acts as wheel bracket strengthener.

TRANSFER APPARATUS
Sylvania Electric Products Inc., of Massachussetts.—U.K. 810504.

A transfer machine for making lamps which feeds mounts for sealing as per U.S. Patent 2637144, using burners round the envelope neck, and able to cope with different output rates. Two series conveyors are used, with holder spaces, storage being by passing on to a second conveyor if they are not needed on the sealer.

TRENCH DIGGER
William Reynolds & Sons, Bedford, Ltd.—U.K. 810609.

An inclined framework mounted on an endless conveyor, towed by a tractor and wheel driven.

CRANE TROLLEY
Koninklijke Nederlandsche Hoogovens en Staal fabriken N.V., of Ijmuiden.—U.K. 810639.

Suspended tong from trolley has rigid connection to avoid tipping, by means of springs on wheels forcing them down.

CONVEYOR
Ritchard Sutcliffe, Ltd., of Wakefield.—U.K. 810651.

A flexible cable-driven carrier, with disconnection before inversion for return.

CIGAR MAKING
International Cigar Machinery Co., of New Jersey.—U.K. 810676.

An improvement on Patent 460712 for high speed machines to wrap and bind cigars, using a cutter coacting with table movement.